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# A STUDY OF
## POTENTIAL CONTRIBUTIONS OF SMALL GROUP
## BEHAVIOR RESEARCH TO TEAM TRAINING TECHNOLOGY DEVELOPMENT

John J. Collins
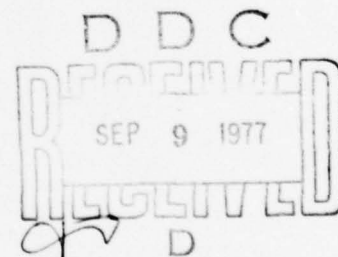
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A review of the small group behavior research literature revealed numerous potential contributions to team training technology development. Theories, methods and techniques, and findings on substantive variables in group interaction, group performance and productivity, group growth and development, and group motives and goals are emphasized. Research program recommendations are presented. An annotated bibliography is included.

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## 1.1   Purpose of Research

The primary purpose of this research was to review the small group behavior literature to identify scientific and technical advances potentially applicable to the development of an improved team training technology.  Selected theories, methods and techniques, and substantive findings were examined in an effort to illuminate relationships among the theoretical and empirical foundations of the disciplines and technologies involved, to identify possible unifying concepts related to the development of team training strategies, and to suggest fruitful areas of research.

## 1.2   Statement of the Problem

Team training is generally recognized by the Department of Defense as an essential and costly program for maintaining military and personnel readiness.  Historically the need to improve team training through team training research and technology development has not been given a high priority in comparison with individual training (Defense Science Board, 1976).  In part, this lack of support is based on earlier research findings which lead to principles which influenced team training such as: (1) training in individual task proficiency is the foundation for the effective team, (2) limiting the amount of team member interaction results in better performance, and (3) early training in coordination interferes with individual skill attainment (Briggs and Johnston, 1967; Klaus and

Glaser, 1970; Horrocks et al., 1960, 1961). As is indicated in the studies described below, these research findings are not unequivocal, nevertheless they have served to limit the development of a team versus individual training technology. Team training technology is defined in this study as the body of knowledge (theories, methods and techniques, and substantive findings) involved in the design and implementation of training system activities such as: (1) defining team training requirements (duties and tasks requiring instruction, degree of proficiency required, number of personnel to be trained in what period of time), (2) development of objectives and achievement tests (identification of behaviors, criterion and enabling objectives, and entering behavior and criterion tests), (3) planning, developing and validating instruction (sequencing of learning activities, selection of media, identification of resources requirements), (4) conduct and evaluation of instruction, and (5) operational evaluation of the training system (team performance, cost-effectiveness). Team training technology is conceptualized as focusing on the team as a functioning unit and the performance of that unit rather than just the performance of individual team members.

The following reflect new and recent concerns in the Department of Defense and the Department of the Navy about both operational and technical requirements in team training and team performance.

The Chief of Naval Education and Training sponsored a comprehensive review of operational team training programs and technical deficiences in team training technology (Hall and Rizzo, 1975). The findings and recommendations of the

resulting report emphasize needed improvements in:

1.  developing objectives for team training.

2.  composing a training environment.

3.  conducting training exercises.

4.  applying a systems approach to team training.

5.  applying current research knowledge to practical training situations.

6.  identifying (1) critical performance variables in team tasks, (2) variables and situations which determine legitimacy of a "team" and (3) decision rules for determining when or where a team approach rather than only an individual approach is appropriate.

From their review of the technical literature, Hall and Rizzo conclude that "technically, the question of whether individuals functioning in a team setting require unique skills which can only be developed through training in a team context remains unsolved." These authors also state (p.34): "Of particular interest are the underlying social aspects of team behavior which seem to affect performance. The manifestation of "team awareness," adaptive, as well as creative behavior, seems to be crucial to effective team performance."

The Department of Defense Science Board Task Force study on Training Technology addressed a variety of training requirements, including team training, and training research and development planning and utilization of results. Specifically, the following issues enumerated were: (1) procedures to establish Training Technology R&D requirements and priorities within OSD and the Military Departments, (2) technical, administrative and managerial capability to

provide responsive Training Technology R&D programs that
address critical DoD training and education problems
with maximum efficiency for minimum costs, and
(3) approaches to expedite application and implementation
of Training Technology R&D output (Defense Science Board,
1976).

Some of the unresolved problems from the report
identified as requiring increased support by both the
operational and research communities are:

1.  better assessment methods for costing and
    training effectiveness.

2.  close coordination and cooperation of train-
    ing technology R&D and both training and
    operational user commands and working units.

3.  insufficient attention is now being given
    to the training of crews, groups, teams and
    units.  This is an area in which significant
    improvements in efficiency and effectiveness
    are now possible.

4.  insufficient assessment (test and evaluation)
    of advanced training methods and of prototype
    training equipment and simulators.

5.  some question exists regarding the degree to
    which SAT (Systems Approach to Training)
    (or ISD) is being correctly implemented, and
    there is little or no evidence of its actu-
    ally producing cost-effective results.

From the detailed examination of CGTU (Crew, Group,
Team and Unit) training, the report contains comments and
recommendations as follows:

1.  Scope of CGTU Training - The circumstances of
    embeddedness (in the operating forces) make it
    difficult to identify, for purposes of this
    study, what the Services do recognize as CGTU
    Training, or to obtain corollary data on student
    loads and training costs (p.36).

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2. CGTU Training R&D - Despite the magnitude of CGTU Training in the Services, there is very little R&D on CGTU Training at the present time. Also there are marked differences among the Services with regard to stated requirements for CGTU Training R&D. The Army (TRADOC) is currently emphasizing the need for and importance of Training Technology R&D in this area (p.36).

3. Hardware Technology Advances - Relatively recent advances in hardware, such as the laser, the digital data-processing system, and large-scale integration (LSI) of digital circuits, constitute potentials for improving some types of CGTU Training (p.36).

4. Range of CGTU Training R&D Requirements - A wide range exists from (a) routine but important servicing of user needs and R&D on training-system variables, to (b) the generation and nurturing of bright ideas that may offer substantial improvements in performance and/or reductions in cost (p.37).

5. Recommendations - Initiate systematic R&D to develop a taxonomy of operational force elements (crews, groups, teams, and units), and on methods for controlling training variables in the context of process-control models. This R&D should have first priority to establish a framework for subsequent, programmatic R&D on CGTU Training (p.37).

During this same time period, the Defense Advanced Research Projects Agency sponsored a state-of-the-art review of selected team training and evaluation strategies, the purpose of which was "to provide information to the Defense Advanced Research Projects Agency which would be useful for planning research and development programs in the area of team training" (Wagner et al., 1976). In suggesting a research program in response to this requirement, Wagner et al. state: "the major factor in this program is the need

for methods which differentiate individual, multi-individual, and team skills and training requirements....Possible techniques to study for this purpose are variations of interaction analyses and other unobtrusive measures" (p.4).

In summary, it is clear from these studies above that improvements in team training are needed to meet urgent operational and administrative requirements. On the technical level, little progress is reported during the past several years in part due to a lack of research and development support, and in part due to the limitation of research strategies historically employed. Fundamental unresolved issues cited in the literature, as well as being voiced by operational training personnel, relate to:

1. the definition of a team in meaningful operational and training terms.

2. distinctions between teams and small groups.

3. identification and development of team training objectives and technologies

4. relationship between team training and team performance.

5. the adequacy of team training system design and implementation methods such as instructional system design.

1.3  Objectives of Research

The rationale for this study takes the form of publicly-expressed military operational requirements for improvements in the state-of-the-art in team training technology, and a preliminary assessment of the potential for resolving some of these problems through the application of theories,

methodologies and substantive findings from small group behavior research. This latter view derives from both changes in directions and advances in small group behavior (Hare, 1976; Steiner, 1972; Hackman and Morris, 1975; Federico, 1976; Zander, 1971). Federico (1976), for example, conducted a literature review to determine the degree to which computer simulation could be used to overcome the myriad of obstacles impeding "the scientific understanding of, and the application of knowledge to, psychological and sociotechnical systems." A general conclusion from Federico's findings is that a large body of knowledge exists in such areas as small group structure, social process modeling, goal setting, social learning, and group performance and measurement. Similarly, Hackman and Morris (1975) identified numerous findings from their review of group interaction and group performance effectiveness research which can be considered for integration with the findings to advance team training technology. Steiner's (1972) and Zander's (1971) contribution in the areas of group productivity and group motives and goals provide other data of potential utility in this regard. The main substance of this report is directed toward the analysis and integration of information from these and other theoretical and empirical developments for the purpose stated above.

Within this context, the primary objectives established for this study were:

1. to review and analyze selected portions of the literature on theoretical and empirical research in team training and small group behavior.

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2.  to illuminate the relationships among the
    disciplines and technologies involved at
    the levels of theory, methods and tech-
    niques, and substantive variables.

3.  to identify a set of unifying concepts
    for developing an improved team training
    technology.

4.  to collect, assess and synthesize informa-
    tion on scientific and technological trends
    and gaps in these two areas.

5.  to develop an annotated bibliography of
    relevant reference materials.

6.  to develop recommendations for research to
    fill the scientific and technical gaps,
    and for capitalizing on advances supportive
    of team/crew/group/unit training require-
    ments.

The objective of identifying a set of unifying concepts
(objective 3 of the project) was viewed principally as one
of searching the literature for concepts, findings and new
methodologies for dealing with fundamental issues relating
to team definition, team training and team performance.
Optimistically one might identify concepts and findings
from research on a number of variables which might improve
systems of classification and assessment of small group
behavior research and facilitate development of generaliza-
tions across disciplines.  On the other hand only suggestive
theoretical formulations and empirical findings might be
identified which provide for some integration, or develop-
ment of researchable or, at varying degrees of confidence
and risk, operationally-usable approaches to improving team
training and related issues.

## 2.0   RESEARCH STRATEGY AND METHODS

### 2.1   Literature Review

The research strategy included first a literature
review and compilation of information from two substantive
areas, i.e., team training and small group behavior.  The
planning of the literature search recognized the differing
characteristics of the body of scientific and technical
information in the two areas.  For example, in the area of
small group behavior, research investigations and reports
have been voluminous over the past twenty-five years.
Hare's (1976) revised handbook includes 6037 references
compared to less than 1400 in the 1962 first edition.
Whereas in the area of team training, there has been very
little research conducted and reported on in recent years
(Hall and Rizzo, 1975; Meister, 1976; Wagner et al., 1976;
Defense Science Board, 1976).  Of particular significance
has been the absence of theoretical research on team opera-
tions, development and performance.  In contrast, within
the area of small group behavior, Steiner (1972) notes the
renewed interest in the group as a productive unit and the
shift from attention to processes that occur within the
single individual.

These and other contrasting conditions prompted differ-
ent approaches to the literature review and the collation of
results.  For the team training area, comprehensive coverage
of published research during the past twenty-five years was
sought.  Summary reviews of work completed prior to 1967
were available and were supplemented by reviews of primary
source materials where deemed necessary.  For the period
subsequent to 1967, the principal references available were

reviewed and reported on.

The review of the literature on small group behavior
involved a process of selection based primarily upon:
(1) the practical problems of applying project resources
in an effective manner to the large amount of published
information, and (2) collecting and processing the most
relevant information. On the basis of these two consid-
erations, the search focused initially on recent summaries
of small group behavior research and the published works
of well-known researchers (e.g., Hare, Steiner, Hackman
and Morris, Zander, etc.), and on primary references
collected from systematic searches of automatic informa-
tion systems, library sources, recent bibliographies, etc.
These searches included sources such as the Defense Docu-
mentation Center, Naval Research and Development Information
Center, Smithsonian Information Exchange, National Technical
Information Service, Psychological Abstracts Search and
Retrieval, Sociological Abstracts, Advances in Experimental
Social Psychology, Annual Reviews of Psychology, and num-
erous professional national and international journals. The
results of these searches are contained in the reference
list and annotated bibliography.

Many references reviewed are not included in the list
because of their lack of relevance. This situation reflects
the difficulties involved in searching large numbers of
reports which were apparently pertinent by title but on
review were found not to contribute sufficiently to exist-
ing knowledge to warrant their inclusion. This experience
is consistent with that of other researchers (Wagner et al.
1976, p.12). The results of this search strategy are a combin-
ation of primary and secondary references from which a body of

information on theories, methods and techniques, and substantive variables of potential interest was reviewed.

## 2.2  Analysis and Synthesis of Data

The organizing framework for the analysis and synthesis of data centered on two elements of the systems analysis of training (SAT) approach to training system design.  These elements were the development of training requirements/ objectives and operational evaluation of training systems. These two areas were selected as priority areas related to previously-described, fundamental issues of team training system design, i.e., team training definition, training objectives, and team performance.  Other areas of the SAT training system design approach such as selection test development, course design, instructional media selection, achievement test development, and validation of instruction were not included.  Table 1 describes the structure and elements of the instructional delivery system process.

Selection of these two SAT elements provided a focus with which to search and to synthesize the information collected.  The preliminary search included a large number of substantive areas which, after review and analysis, were reduced to those providing theoretical and empirical insights into the training and performance issues of concern. Small group behavior research areas selected for primary attention emphasized small group development and group productivity (performance).  The logic of this approach relates to consideration associated with the development of Navy teams of first term enlisted personnel.  Briefly, the enlisted Navy first term population is largely 17-19 year olds, 69-70% of whom attend formal schooling to qualify for entry into a particular occupational speciality (rating), attend additional schooling to develop more equipment or systems-oriented skills, are assigned to fleet or shore

# TABLE 1 - INSTRUCTIONAL SYSTEM DEVELOPMENT STRUCTURE

| Define E&T Requirements | Develop Objectives and Tests | Plan, Develop & Validate Instruction | Conduct & Evaluate Instruction | Operational Evaluation of the Instructional System |
|---|---|---|---|---|
| 1. duties & tasks requiring instruction | 1. identification of behaviors (knowledges, skills, attitudes) required for successful performance | 1. planning of instruction to satisfy learning objectives | 1. improvement & redesign an integral part of process | 1. operational and administrative criteria for evaluations |
| 2. degree of proficiency to be developed | 2. a. criterion objectives: end-behaviors and conditions under which they are to be demonstrated |    a. sequencing of learning activities or exercises to achieve results in shortest time | 2. student attainment or non-attainment the primary method of evaluation | |
| 3. number of personnel to be qualified |    b. enabling objectives: |    b. selection of methods, media, & equipment which most effectively supports learning objectives | 3. meeting requirements of operating commands; i.e., man can do what he is taught to do. | |
| 4. time required to develop instruction |     1. prerequisite knowledge & skills essential to attainment of criterion objectives | 2. identify resource requirements | | |
| 5. criticality & learning difficulty of tasks |     2. criterion tests to measure student achievement and effectiveness of instructional systems; also entering behavior measurement |    a. development and validation of instructional materials | | |
| 6. availability & qualifications of personnel to operate the instructional system | | 3. validation to insure all elements are functioning effectively | | |

organizations to be integrated into teams, and during their term of enlistment of 4-6 years, they are assigned to one or perhaps two more organizations receiving more advanced training in schools or in on-the-job training. Implicit in this general pattern are several areas of development including physical, emotional, intellectual, occupational, etc., of particular importance to young men and women in this age group. Study of these various kinds of developments and the ways in which they interact within the military environment has not been reported in the literature, and is beyond the scope of this study. However, this study attempts to examine theoretical and conceptual approaches to small group development which might provide some insights into this process of development and performance and suggestions for fruitful research. The analysis and synthesis of the small group behavior research literature have been approached, therefore, with the objective of determining contributions from theoretical, methodological and substantive findings to the understanding of team training and team performance within a group development framework and in the context of a systems analysis of training approach.

Further discussion of systems approach of training concepts is considered desirable at this point to provide additional perspective on the synthesis of the information collected. Montmerlo and Tennyson (1976) reviewed the historical developments in systems approach to training (SAT) or instructional systems development (ISD), and provided a bibliography of approximately 4000 entries dating from 1951. They report that they find the state-of-the-art to be "unsettled." More than 100 ISD manuals are identified which contain fundamental disagreements on the basic concepts of course design and none of these manuals has been empirically validated.

The authors point out that the original SAT concept based upon systems analysis included three main features: (1) use of an interdisciplinary team of experts to maximize the application of as much relevant information as possible, (2) use of "models" for reducing complex problems to analyzable proportions, and (3) design of a unique method for solving the problem which is as systematic as the problem will allow (p.9). The contrasting approach which developed was based on the hypothesis that experts could develop models of the methods and techniques which reduce the design of training programs to a linear sequence of procedures which can be successfully followed by personnel inexperienced in program design. The generic concept denied that such complex problems could be solved procedurally.

The original SAT concept is receiving renewed interest as a result of recent reassessments and conclusions that "available theory and empirical evidence on the process of learning and teaching do not support the proceduralization of the training program development process" (p.12). However, both approaches are being applied and both require extensive empirical research to identify which approach is more effective and efficient or what synthesis of the two approaches is desirable. The feasibility of developing ISD following the original concept for application to team training rather than its traditional use for individual training is examined in this report.

## 3.0 THEORETICAL AND METHODOLOGICAL DEVELOPMENTS AND TRENDS

### 3.1 Team Training Research Trends

The evolution of the technology of team training has been strongly influenced, beginning in the early 1960's, by concepts of systems analysis and military weapon system development approaches (Gagné, 1962; Glaser, 1962; Monte-merlo and Tennyson, 1976). As a result, team training and team training research have developed goals, methods of development and investigation, and evaluation criteria distinct from a psychology of learning (Eckstrand, 1964). In addition, because of the demands of the systems approach to training to demonstrate the operational relevance of the training content and the levels of training achievement, team training and team training research should be more closely tied to team performance (Briggs and Johnston, 1967; Meister, 1976). These demands stem from the heavy emphasis on mission, function and task analysis in defining training requirements, and on the operationally-oriented criteria required for evaluating training in school and operational environments. The development of acceptable performance feedback systems for these purposes is yet to be accomplished.

The Defense Science Board recently reported that the cost of training in the Department of Defense approximates $7 billion annually not including training conducted by operational units (Defense Science Board, 1976). On economic grounds alone, a rationale exists for directing

considerable effort toward insuring the efficiency and effectiveness of training. The previously-mentioned systems approach to training is designed to support such an objective, but whether this approach has in fact achieved its objectives has been questioned by the Defense Science Board (1976). Nevertheless it is and will undoubtedly continue to be the principal approach to training program development and evaluation (USAF 1970, 1973; Branson, et al., 1975; Montemerlo and Tennyson, 1976).

During the period of development and implementation of systems approach to training techniques, two trends have negatively influenced the development of team training and team research. One is the emphasis on the study of individual behavior in the DoD Human Resources RDT&E program, resulting in a limited program of team training research and development beginning in the mid-1960's and continuing through at least FY 1977. Recent reviews by Hall and Rizzo (1975), Wagner, et al. (1976), and program searches by this writer as part of this study, document the limited amount of team training research in recent years and in DoD planned programs (Defense Documentation Service, 1976). Wagner, et al. (1976) included 97 references in their review of the state-of-the-art beginning with 1952, of which 11 are technical reports related to team training published between 1970-1976, an average of less than 2 per year. Meister's (1976) citations in his chapter on team functions, including team training, reflect this same condition. The Defense Science Board (1976) report recommendations for increases in the level of resources for development and implementation of new team training technology are directed toward reversing this trend.

Gagné (1962, 1965), assigning secondary importance to traditional learning principles, set forth basic principles of training design in the context of system development. The principal thrust of Gagné's conceptualization was to emphasize what must be learned and what the substantive content of training must be to insure transfer to totaltask performance. Training studies using a systems approach to training purport to be an implementation of these concepts but questions have been raised as to whether SAT has been applied correctly.

With regard to a second trend, team training theory and models development, the field may best be described as characterized by an absence of trends. What one observes are sporadic efforts in theory development within a limited number of highly-specialized conceptual frameworks. Alexander and Cooperband (1965) summarized this research in terms of two categories of theories involving characteristics of task-oriented teams and how they learn - the organismic theories and the S-R theories. Organismic theory emphasizes temporal processes of development growth, and performance is related to level of development. Coping with adaptation to, and manipulation of the environment are viewed as essential for growth. Development of system awareness, an integral model of the environment, and the exploitation of the potential self-organizing or adaptive capability of a team are assumed to underlie the development process. The development and growth concept has been supported by limited amounts of research on stages in the development of cooperative behavior (Jordan, et al., 1963), stages in the development of skill in analyzing errors and in dealing with them (Boguslaw and Porter, 1962), and by the development of rules (principles) of team development (Kennedy, 1962; Chapman

et al., 1959).  It should be noted that these are not recent
studies and no recent efforts related to these concepts were
identified in the literature review on team training.

Research by Glaser and his associates emphasizing the
application of principles of operant conditioning to team
training is classified in the stimulus-response category
(Klaus and Glaser, 1970).  In their early studies, Glaser
ans his colleagues conducted direct examination of Navy
operating teams and found hazy, changing boundaries and
functions which led them to focus attention on individual
members and their responses within the team.  Detailed
analysis of team training led these researchers to under-
score the importance of the information processing and
feedback aspects of team behavior, and the supervisory
and monitoring functions in the team (Glanzer, 1962).  In
a  later  series of seven studies during 1960-1967, Glaser
and his associates studied the team, rather than indi-
vidual members, and the team product as a whole as the
units of investigation, to determine the effects of various
conditions of reinforcement.  One general conclusion
reached was that intact teams can be considered in much the
same way as individual learners have been considered in the
past.  Also, that the performance of a team is predictable
from a knowledge of team arrangements and individual
member's proficiencies (Klaus and Glaser, 1968).  These
authors state, "the theoretical implications of this pro-
gram of research principally reflect the notion that a
team can be defined as a group of individuals who all are
reinforced by a single event and the notion that the per-
formance of a team can be a suitable module of behavioral
investigation.  This approach is closely analogous to

that used to study a sequence of responses or "operant chain" as it is called in the learning laboratory" (p.55).

Alexander and Cooperband (1965, p.20) compare the two theoretical models by noting:

1. both models reflect reality but differ in their assumptions regarding behaviors to be trained in order for overall performance to improve.

2. the S-R model applies to teams operating in established situations, i.e., almost completely specified tasks, rigid with regard to organization of tasks and assignment of functions among members, and limited coordination requirements within a highly-determined series of responses.

3. the organismic model is oriented toward teams primarily in emergent situations involving a high degree of discretionality for performing tasks under various environmental conditions; proficient team performance depends upon cognitive organization of the environment and idiosyncratic team procedures; coordination involving development and modification of plans which integrate operating procedures; requires adaptive innovations.

4. there is essential agreement on which variables are likely to affect team performance improvement but different emphasis placed on each because of different initial assumptions regarding behaviors to be trained and the products of training.

Alexander and Cooperband (1965, p.37) present their view of a team, which reflects their preferences regarding theoretical positions, as follows:

"The team is an information processing system which has a large storage capacity, part of which is devoted to procedures for action that are organized hierarchically into plans which coordinate the behavior of the individual members. These plans may be given to the

team (e.g., by the system designer) or they may be generated by the team itself based on previous experience with the environment. The task situation determines which plan(s) will be utilized. The performance of the team depends on how good the plans are and how well they are executed. As a result of continuing experience with the environment, the team generates and tests new plans and adopts some of them. The rate of generation, testing, and adopting new plans, the quality of new plans, and the level of skill in executing them may be modified by manipulating the experience of the team and will be reflected as a change in team performance. This entire process may be considered as a two-level learning process: learning the characteristics of the environment, and learning new methods for responding to it. To the extent that what is learned at either of these levels can be transferred to new and indeterminate situations, team performance will improve."

Wagner et al. (1976) reviewed the training research literature and classified available research investigations in terms of emergent and established situations. Boguslaw and Porter (1962) previously introduced this concept in an effort to draw attention to the situational context in which teams exist. They suggested a continuum which extends from a high degree of specificity about "environment" states and conditions, and the adequacy of research technology for predicting consequences of alternative actions to unspecified states and low predictability. Laboratory investigations are viewed as falling within the established category and field research within the emergent category. Wagner et al. (1976) used a second dimension, team versus multi-individual, to provide a 2x2 matrix for classifying the team training research reviewed. The matrix was used to classify studies which included consideration of individual versus team training, team skills, simulation fidelity, feedback/ knowledge of results, team structure and composition. Some

of the trends identifiable from this classification scheme are: (a) most of the studies and classified team/established (laboratory) category, (b) feedback and knowledge of results studies of teams/established are largest in number, (c) no studies of team skills in the team/established category are reported, (d) few studies in simulation fidelity are reported for either team or multi-individual category, and (e) most of the studies of team structure/composition are classified in the team/established category. Wagner et al. (1976, p.3) point out that the investigations which attended to the emergent factors in the job situation had demonstrated the need for training in team skills, even though individual skill proficiency was found to be a prerequisite for effective team training and performance. These authors also note that a major factor underlying their research program recommendations is the need for methods which differentiate individual, multi-individual and team skills and training requirements (p.4). This factor points out again to the absence of trends in team training research to resolve this fundamental issue.

Campbell (1971) reviewed the research literature in personnel and training development, including attitude theory, motivation theory, behavior modification, individual differences, general systems theory, new developments in technique, evaluation methodology, and empirical research. Finding his literature review "disheartening," Campbell cites two principal reasons for the failure of training and development to realize its potential. The first reason is that there has been a broad and full scale retreat from the fundamental task of defining what is to be learned, and the second reason is that there are few incentives available for simulating the effort necessary to develop sound

theoretical models, build a technology of assessing what is to be learned, and accumulate a broad data base (p.594).

Cooperman and Asa-Dorian (1976) described methodological research in anti-submarine warfare training in which a large team trainer is used. The first three phases of the training is ashore at the training center and the fourth phase is at sea. Two commonly-recognized problems cited by the authors are the lack of specific training objectives that can be readily converted into measurable performance criteria and the use of instructor's subjective measures of adequacy of performance in training. This situation is not unique to this particular team trainer. Other problems often mentioned in the training device literature include: (1) failure to use state-of-the-art training technology in design or use, (2) absence of training instructions, (3) overemphasis on training procedures, (4) training teams are "scrub" teams, and (5) trainees often lack the requisite skills. These difficulties combine in various ways to limit the effectiveness of team training, the use of team trainers, and the development of team training technology. The research reported by Cooperman and Asa-Dorian involve development of a graphical representation of training problem events, and a listing of numerical information associated with critical occurrences. Performance of subteams can be determined from the plot developed. Future effort will include development of a variety of computer-based problem (graded) scenarios which will provide a training option that should increase training problem standardization by placing target maneuvers under computer control. These new capabilities are oriented toward improvements in team training requirements, team instruction, and team evaluation.

Two related efforts are Project NORM (Birkett et al., 1968; Zagorski, 1973) and the research of Obermayer et al. (1972). Project NORM objectives included determining how situational variables as measures of exercise difficulty affect SAGE crew performance. Results of an exploratory study indicated that situational variables can be selected as measures of exercise difficulty by linear multivariate regression analysis using performance variables as criteria, factor analysis can identify the best measures of crew performance, expected scores on the selected performance variables can be described from various combinations of the selected situational variables, and actual crew performance scores can then be compared with expected scores. A subsequent study included a field test and demonstrated how different combinations and weights of 13 situational variables predicted each of 8 performance indices. Chesler (1970) discusses the utility of the NORM approach in studying Navy anti-air warfare team training, noting that automated performance evaluation does not resolve the criterion dilemma, nor problems of methodology and rationale for analysis of individual and group behavior. A unique concept which Project NORM does possess is relative performance evaluation which takes into account environmental characteristics and situations in which performance is being measured. As Zagorski (1973, p.5) writes: "The relative performance concept is the key aspect of NORM as it indicates the performance level in terms of potential capability determined by critical analysis of the situational variables operating within the environment."

Obermayer et al. (1972) report on a study to improve the acquisition of aviation combat-crew training performance through the systematic definition of performance measures appropriate to combat training needs, and the definition of

a cost-effective measurement system usable in combat-crew training environments to acquire and process needed training information. The strategy employed in the design of the measurement system emphasized use of data identified as meaningful by training management and instructor personnel. In studying the requirements of six aircraft consolidated into a common framework of maneuvers, more than one hundred measurement parameters for combat-crew training were identified which gives evidence of the magnitude and difficulties in developing meaningful, operational personnel performance measures. In investigating crew interactions through communications measurement, it was stated, "The combat airlift mission in the C-130 and C-141 aircraft involves such close coordination of pilots, navigators, loadmasters and engineers that it is difficult to isolate an individual's performance (even the crewmembers themselves cannot be sure of the adequacy of their performance)" (Obermayer et al. 1972, p.29). The performance measures and performance measurement system developed represent methodological advances but further development and application of this system for aviation training has not been reported.

In summary, trends in the team training technology point to serious problems of underdevelopment (Hall and Rizzo, 1975; Wagner et al., 1976). Some specific capabilities required and lacking programmatic support are: (1) task analysis methodology for various classes of team training, (2) definition of and development techniques for team training objectives, (3) techniques for determining training content for both shore-based and shipboard on-the-job training, (4) objective situation-specific measures of team training achievement and effectiveness and (5) team

performance standards and measures for feedback and other uses. These improvements directly support developing an improved training technology which for the most part must include consideration of complementary classroom, simulator and underway training in some cases. What is especially obvious is the absences of any trends in the development of team training models for different kinds of team training. Failure to use available educational and training technology, as well as to resolve fundamental issues relating to team concepts and team performance, has relegated team training to a questionable state of effectiveness. Without a renewal of priorities and programming of resources, only the most meager changes to this trend can be expected.

## 3.2 Small Group Behavior Research Trends

A review of the history and present state of small group research was published recently (Hare, 1976). One of the more important general trends noted is the accelerated rate of publications which has now reached a level of approximately 200 articles a year. Several small group researchers have expressed concern about the impossible task of classifying and integrating the large quantity of theoretical and empirical research and developing maningful generalization (Insko and Schopler, 1972; Helmreich et al., 1973; Hare, 1976). Similar concerns have been expressed about qualitative deficiencies in the research, particularly the absence of new theoretical formulations (Borgatta, 1960; Hackman and Morris, 1975; Helmreich et al., 1973). Steiner (1964, p.440) concluded from his review of group dynamics that the volume and methodological

sophistication of research have increased but there were
no striking changes of conceptual orientation. Further,
he notes the historical development from armchair specu-
lation to very restrained and cautious theorizing to a
new period of theory and experimentation as partners.

Scientific and technical developments in small group
research parallel that of psychology, particularly social
psychology, and certain areas of sociology (Hare, 1976).
During formative years, researchers found little agree-
ment on the most fundamental issues, e.g., the environ-
mentalist-behaviorists versus the innate-inborn adherents
(McGrath and Altman, 1966). During the period 1898-1905,
most of the central ideas and methods in small group
research appeared. One area of emphasis was whether the
group makes any difference for the individual working on
problem solving tasks and what kinds of problems are
best solved by individuals and groups. A second area of
emphasis was whether individual activity was significant
in the face of group pressure to conform to norms.
Between 1905 and 1920, comparatively little research was
conducted. The period 1920 through the 1930's was one of
rapid growth with emphasis on "together and apart"
studies and the facilitating effect of co-workers on an
individual's performance. Most of the contemporary con-
cerns of small group research began to appear in the
period 1930-1940, e.g., sociometric investigations, group
work, social integration, and group dynamics. From the
mid-1930's to the early 1960's, three main schools of
small group research dominated the field - sociometry
(Moreno), group dynamics (Lewin), and small groups (Bales)
(Hare, 1976). The recent period has seen the continued
dominance by psychologists, followed by sociologists and

then by professionals in psychotherapy, education, social work and business.

Currently psychologists' major technical emphasis is on cognitive balance in social relationships, bargaining, and risk taking. Sociologists emphasize a model of behavior drawn from economics in which "actors" are seen as making exchanges to maximize their social profits at the lowest social cost. Most of this research focuses on the actor not the group. Social psychologists have been studying the relationship between personality variables (mainly authoritarianism) and conformity (mainly in the experimental situation similar to that used by Sherif in 1935 and Asch in 1951. Recently, about one-third of the experimental studies of small groups have been directly related to conformity. Relatively few of the experimenters have worked within a general theoretical context which would allow them systematically to relate their results to the results of others (Hare, 1976). The next largest area of research includes the sociometric studies of interpersonal choice. In some cases those studies are related to the area of social perception involving perceptions about others liking for them or others in the group, perception of personality traits, or other social characteristics. Social perception ranks below interpersonal attraction and about on a level with studies of interaction process in popularity as a research topic. Leadership represents about 10% of the total output for the years 1959-1969. Research topics which are receiving the most attention are quite similar to those which have historically attracted support: conformity, interpersonal choice, social perception, interaction process and leadership (Hare, 1976). Areas receiving little attention since 1962 include roles, personality, social characteristics, group size and various aspects of group produc-

tivity.  Some topics which can be approached by simulation, gaming or simple laboratory experiments, e.g., the helping response, competition and cooperation in games, trust and threat in games, the risky-shift phenomenon, and use of personal space, have been receiving more attention than the older established areas.

Steiner (1972) provided a perspective on the history of the study of group productivity.  He described the earliest research as regarding the group as a setting in which individual behaviors might be influenced by subtle social processes with no attention to pooling individual resources to produce a product.  Just prior to World War II, the focus was on demonstrating the superiority of group action over individual action with diverse findings due to a large extent to the emphasis on productivity and neglect of task demands and process.  After World War II, the emphasis shifted to process and ignored productivity. Steiner (1972 , p.10) cites the research using interaction process analysis (Bales, 1950) and the "group dynamics movement" (Lewin, 1951) as examples.  This post war shift also involved discarding the "ad hoc" group and shifting to "synthetic" groups which turned out to be equally un-productive as a research strategy.  Steiner notes (1972, p.12) the increasing interest in attempts to analyze task demands and the efforts of some researchers to conduct group productivity research using strategies more effective than those contained in the general trends described above.

Theoretical research in small group behavior is roughly divided into two areas: experimental (group pro-ductivity, risky shift, etc.), and the experiential (effec-tiveness of T-group training, interpersonal trust in groups,

etc.). In the experimental areas much of the stimulus
for theory building stemmed from the work of Lewin's
field theory, Bales' interaction theory, systems theory,
Moreno's work in sociometric relationships (Cooper, 1975).
Much of this stimulus took the form of insightful observa-
tion and speculations but could not be considered compre-
hensive theories. Since the 1950's, efforts to objectively
evaluate phenomena earlier speculated upon have been strongly
empirical and devoid of theoretical formulation. It is this
large volume of research literature which various researchers
have found so difficult to develop a classification system
for and from which to identify meaningful generalizations,
or to integrate into theoretical formulations except in a
limited way.

Cooper (1975) writes that the development of exper-
iential group psychology is similar to the experimental area.
In the experiential area much of the speculation stemmed from
the works by Argyris, Bion, Bennis and Shepard, Tannenbaum,
et al. Again an enormous amount of empirical research has
been conducted, much removed from early conceptualizations.
Some theoretical work has been pursued (Mann, 1967; Argyris,
1962; Golembrewsi, 1972; Cooper, 1969), but in a narrow and
restricted form (Cooper, 1975). The developments in the
experiential area have provided some insights into theoreti-
cal formulations for effective group learning environments,
interpersonal variables (i.e., personal theories of action),
individual differences in learning styles as it relates to
group processes, and some group process variables (e.g.,
group support).

Helmreich et al. (1973) published a review of small
group behavior research for 1967-1972 "concentrating on

approaches where methodology, theoretical impact, or
application seem most promising." The authors repeat
the commonly reported concern about the absence of uni-
fying theoretical position on group dynamics, lack of
concern with external validity or potential application,
the "mundane significance" of the literature over the
past ten years, and the impossibility of conducting a
comprehensive review of the field.

In the area of methodology, the authors find that
most of the innovations center on naturalistic research
with attention to systematic observation, objective cod-
ing of natural phenomena, and treatment of extensive
longitudinal data. The authors note the lack of involve-
ment with statistical techniques for the analysis of
multivariate repeated measures, designs and procedures
for making causal inferences from such data. Path analysis
is cited as one fruitful approach to the search for
causal inference from correlation data. Apparently more
developments have been taking place in sociology than in
psychology (Helmreich et al. 1973, p.338).

The substantive areas covered in the review include
attraction, conformity and social influence, cooperation
and competition, performance, leadership, encounter groups,
and a postscript. In the postscript the authors provide
a few predictions about the directions that research will
take over the next few years: (1) increased emphasis on
studies of processes within groups and on the interactions
of multiple situational and individual variables over time,
(2) more attention to multivariate, longitudinal research,
(3) greater acceptance and testing of cognitive models and
cognitive phenomena, and (4) a shift from the laboratory

environment to nonexperimental research involving the systematic study of groups over time (Helmreich et al. 1973, p.350).

The substantive area of primary interest in this article is performance which covers social facilitation, task performance, and the risky shift. The findings are included later in the section on performance.

Gibbard et al. (1974) reviewed methods and techniques employed in the analysis of groups and point out that drawing distinctions between experimental and experiential methodology can portray more polarization than exists and thereby create unnecessary controversy. Continuing, they note that studies in small group field can be arrayed along the statistical-clinical continuum. The work of Bales (1950), with his act-by-act scoring system for group interaction-interaction process analysis, emphasizes the sociological tradition. This system has provided some generalizations about group development, role differentiation and individual differences in a variety of settings. Other similar scoring systems have utilized sign process analysis to study the development of self-analytic classroom groups (Mills, 1964), and to assess the feelings of members in various classroom groups by member-leader and member-member scoring system (Mann, 1966; Mann et al., 1970). These approaches emphasize reductionism and statistical treatment of atomistic events to elicit patterns of group behavior. Weick (1968) provides a review of the literature on the numerous approaches developed for coding interaction in groups, of which the above three are illustrative.

Other methodological approaches cited include the work

of Leary (1957) who postulated two orthogonal bipolar
dimensions: the dominance-submission and love-hate
dimension. Efforts to develop this concept into a scor-
ing system for groups have not been very productive.
Schutz (1958) used an observer rating form and observa-
tion system based on the needs for inclusion, control
and affection. Thelen (1954), basing his efforts on
Bion's theory of group-"basic assumption" activity,
developed a system for scoring group interaction. The
common objective in these approaches is to code verbal
interactions systematically in an effort to identify
more nearly universal dimensions of social interaction.

A somewhat different approach within the general
statistical category focuses on postmeeting variables which
include a larger representation of group members not just
the verbally-active members. An example of this approach
is that of Dunphy (1964, 1968) who used postmeeting writ-
ings of the week's events in two self-analytic groups to
study role differentiation and group development. The
technology in these studies is a computer-based content-
analysis system. A limitation of this approach is failure
to take into account the context and connotation of the
content being coded.

The clinically-oriented approaches also seek to
develop unifying concepts of group behavior but their
methodology is global rather than atomistic and impression-
istic rather than statistical. Bennis and Shepard (1974)
represent this approach, along with Bion's (1959) and
Slater's (1966) theories and methodologies. Much of the
group therapy literature that is case-study oriented and
most psychoanalytic work is in this category. Although

difficulties in operationalizing and quantifying the
processes involved exist in the clinically-oriented
approach, there is a body of knowledge produced which
should not be discarded solely on the basis of the prefer-
ence for a statistical approach.

Some investigators have attempted to utilize both
methods.  Bales (1970) combines his interaction process
analysis with factor analysis investigations for more in-
depth studies of individuals.  Mills (1964) also used his
scoring system to formulate a more global theory of the
development of a working group.  What is important to
emphasize is that what is occurring in these efforts are
attempts to achieve the goal of a more unifying theory
of interpersonal and group behavior by utilizing statisti-
cal methods not by combining statistical and clinical
approaches.

Some efforts have also been made to use quantitative
techniques to code behavior such as feelings, unconscious
processes, defense and group climate.  The work of Whitaker
and Lieberman (1964) and Stock and Thelan (1958) is indica-
tive of efforts to operationalize and make concrete Bion's
impressionistic concepts of group life-work versus the
basic-assumption activities of fight/flight, dependency
and pairing.  The previously-mentioned work of Mann and his
associates also focused on clinical variables using the
Bale's-type scoring system and dealing with categories
such as hostility, affection, power relations, and thematic
categories.

Gibbard et al. (1974, p.10) note from their review
of the studies attempting to combine the two categories of

methods in small group research:  "Trying to combine
systematic observation and quantitative analysis with
variables familiar to the clinician is a worthy goal
that has yielded worthwhile results.  At times, though,
it seemed as if the work had too many numbers for the
working clinician and yet was too impressionistic and
subjective for some experimental social psychologists."

McGrath and Altman (1966) assessed small group
behavior research methodology and identified several
characteristics of concern.  One was the wide varia-
bility in "rigor and methodological sophistication" in
various studies from case studies to complex experimental
investigations on large samples of groups.  A second prob-
lem area identified was the settings for small group
research most of which was conducted in laboratories and
few in natural settings.  A third problem area noted was
the tremendous diversity of terms, concepts and operations
which were used and the relative lack of replication of
studies in general and on substantive variables in partic-
ular.  These authors reported that they found only one
instance of "near replication" among the hundreds of
studies they examined and this was in the area of the
interrelations among group cohesiveness, pressures to
conform and productivity (p.68).  McGrath and Altman also
observed that "the small group field seems to be shot
through with idiosyncratic concepts and labels used by
only one investigator and his disciples.  Without the
development of a common-shared lanuage, they see continu-
ing difficulties in the growth of a body of knowledge.
McGrath and Altman (1966, p.69) cite three more specific
needs to be met to achieve the goal of systematic accumu-

lation of knowledge: (1) more replication of studies, (2) more terminological rigor, even standardization, and greater concern with the task of construct validation. Finally, in addition to changes relating to replication of studies, selection of terms, construct validation of operations, and choice of research strategies and settings, McGrath and Altman emphasize that the use of appropriate data collection and analysis approaches for investigating multivariate interdependence in small groups must be practiced as well as preached.

Glanzer and Glaser (1959, 1961) provided a comprehensive review of the work on group structure and behavior, first within the context of the analysis of structure and later as an effort to document empirical studies of the effects of structure in small groups. In the former study, they reviewed techniques for analyzing the structure of groups that had been permitted to form their own patterns of interactions, whereas in the latter study they reviewed studies in which experimenters imposed structures and measured the effects on performance. In both papers, the substantive area of interest was communications structure.

Glanzer and Glaser (1959) described a variety of mathematical techniques related to the measurement of the interactions of communications of a group, its structural characteristics. Focusing on the mathematical techniques growing out of sociometry, they describe the potential contributions in areas such as construction of indices for group and individual characteristics, the enumeration of structures, comparison of groups, analysis of subgroups, assignment of individuals to subgroups, and graph theory

application to problems of group organization. Glanzer and Glaser (1959, p.331) note that the mathematical techniques must become better known and applied, but then "in most cases they will probably be helpful only in clarifying the requirements for adequate descriptive or explanatory systems. At best, these techniques will provide the variables to be incorporated in such theories."

In their second paper, Glanzer and Glaser (1961) grouped the empirical studies reviewed under the following headings: the initial work, variations and further analysis of the basic design, mathematical analysis, emphasis on the distribution of functions in the simulated team, and emphasis on feedback and learning. The significance of the empirical findings is discussed in a later section of this report. Of interest here are theory and methodological considerations. Glanzer and Glaser (1961, p.26) conclude, "at the present time, there is still a major need for a system to order the data already obtained and to direct further work on the effects of group structure. The difficulty in constructing this system may arise from the inappropriateness of either the experimental situations or the concepts that have been used. Attempts have been made to remedy both of these possible defects. The success of these attempts will determine whether this review is a prologue or an epitaph."

The above trends in theoretical and methodological developments in small group behavior indicate potential opportunities for enhancing past team and team training research, particularly for emergent situations. A more in-depth review was therefore conducted based upon the encouragement received from the above results.

Several substantive areas were selected for review
both as indicative of trends and as potential areas of
contribution to the development of unifying concepts between
team training and small group behavior. Theoretical develop-
ments in experimental learning, group development, group
productivity and performance, and group motives were examined
and are described below.

The work of Kolb and Fry (1975) provides insights into
efforts to develop an applied theory of experiential learn-
ing. This theoretical work has its base in the Lewin contri-
butions on group dynamics, the subsequent developments in the
laboratory training method and T-groups, and the methodology
of action research in organizational development. The con-
ceptual orientation encompasses change and growth best
facilitated by a closed-loop process involving immediate
experiences, observations about those experiences, analysis
of that data and feedback of the conclusions for use in
modifying present behavior and choice of new experiences
(Kolb and Fry, 1975). Argyris (1975) notes in his review of
new directions in experiential learning that "learning
processes that excluded cognitive dimensions, deemphasize
task achievement and effectiveness, while emphasizing
warmth and interpersonal closeness, left themselves open to
serious questions of whether they could achieve their purpose
of educating the whole person." Kolb and Fry (1975, p.34)
similarly state that "the experiential learning model
emphasizes that learning and change result from the inte-
gration of concrete experiences with cognitive processes:
conceptual analysis and understanding." This model also in-
cludes the role of individual differences in learning style,
the concept of growth and development, and a model of learn-
ing environments that is commensurate with the experiential

learning process. With reference to the latter area, a central concept is that tension and conflict characterize experiential learning and the learner needs different abilities to deal effectively with these conditions. The four basic adaptive modes or ways of relating to the world are concrete experience (CE) versus abstract concept-ualization (AC), and active experimentation (AE) versus reflective observation (RO). To accommodate this concept in the theory, a learning style inventory provides an identification of four different learning abilities related to the four modes. A typology based upon dominant learning abilities includes covergers (AC/AE), divergers (CE/RO), assimilators (AC/RO), and accommodators (CE/AE).

In addition to the emphasis on individual differences in learning styles, the theory also emphasizes growth and development and normative approaches to these. A three stage development process from birth to full adult life include acquisition (to adolescence), specialization (early adulthood to mid-career) and integration (through adulthood). Growth is seen as proceeding from dependence and defensive-ness to self actualization, independence and self-direction. The stage of specialization is particularly of interest to military training since it covers the period beyond adoles-cence through mid-career. Kolb and Fry (1975, p.41) describe this stage as follows: "Specialization, extends through formal education and/or career training and the early experiences of adulthood in work and personal life. In this stage development primarily follows paths that accentuate a particular learning style. Individuals shaped by social, educational and organizational socialization forces develop increased competence in a specialized mode of adaptation that enables them to master the particular

life tasks they encounter in their chosen career (in the broadest sense of that word) path. This stage, in our thinking, terminates at mid-career although the specific chronology of the transition to stage three will vary widely from person to person and from one career path to another."

The final elements emphasized are the role of the environment, the person-environment interactions, and the development and use of models based on theory to design and implement learning situations. The authors (p.52) set forth three theoretical implications, based on elements of theory discussed, for an applied model of environments: (1) environment must be more broadly defined than in current formal educational approaches, (2) observable and controllable factors in the environment can be related to individual differences as expressed in behavioral learning styles, and (3) person-environment interactions must be related in the content of growth and development goals for the learner.

Based upon a survey of more than 100 students who had completed an introductory, experientially-oriented course in human factors in management, Kolb and Fry developed a tentative typology in terms of personal growth dimensions discussed earlier: affectively-complex environments, perceptually-complex environments, symbolically-complex environments, and behaviorally-complex environments. In distinguishing between preference models and contingency models for matching environments to learners, the authors point out that in addition to typical educator or employer goals, the learner's growth and development needs must also be taken as goals, and determinations of environmental factors must include distinctions between what the learner likes, wants, needs or prefers. Military team training traditionally has not included these

goals, and the narrow task orientation in the application of ISD precludes consideration of such goals.

Throughout the literature on small group behavior the distinction is drawn between experimental social psychology knowledge based on experimental, hypothesis testing, laboratory-based research with its reliance on statistical data, laboratory manipulation of variables and social psychological "laws," and the experiential social psychology knowledge based on either naturalistic-clinical approach using subjective and clinical inference as essential to observations of groups in various settings. These two points of view are restated to invite attention to the criticism that the former research is sometimes criticized as being "sterile, dry, and of little value to those professionals who deal with groups on an everyday basis" (Gibbard et al., 1974; p. XIV). The theory of group development reviewed below, with its conceptualization based in group dynamics, might provide some insights into whether work in this area can provide theoretical and empirical support to the experimental area in becoming more useful to practitioners.

Bennis and Shepard (1974) report on their efforts to develop a theory of group development based upon observations made over a five year period of teaching graduate students group dynamics. The theory focuses on problems involved in improving the internal communications systems in groups. By giving attention to the organic properties of groups, the authors believe that criteria can be developed by which phenomena of development, learning and movement toward maturity can be identified. Maturity means that the group can resolve its internal conflicts, mobilize the resources, and take intelligent action if it has a means for consensually validating

its experience. The authors state (p.129) "the core of the theory of group development is that the principal obstacles to the development of valid communication are to be found in the orientations toward authority and intimacy that members bring to the group. Rebelliousness, submissiveness, or withdrawal as the characteristic response to authority figures; destructive competitiveness, emotional exploitive-ness, or withdrawal as the characteristic response to peers prevent consensual validation of experience. The behaviors determined by these orientations are directed toward enslave-ment of the other in the service of the self, enslavement of the self in the service of the other, or disintegration of the situation. Hence, they prevent the setting, clari-fication of, and movement toward group-shared goals."

The group moves from preoccupation with authority relations to preoccupation with personal relations. These two phases authority (dependence) and personal (inter-dependence) have three subphases. In the dependence phase, the three subphases are dependence-flight, counterdependence-flight, and resolution-catharsis. This phase deals primarily with the distribution of power, and ends with the acceptance of mutual responsibility for the fate of the group and a sense of solidarity but the implications of shared responsi-bility have yet to be explored. During phase II, which has three subphases, enchantment-flight, disenchantment-flight, and consensual validation, there is a change in emphasis from power to affection and from broad role distinctions such as class and professional interests to personality modalities such as reaction to failures, warmth, anxiety and retaliation. According to Bennis and Shepard (p.149) communications is facilitated by members of the group's acceptance of each other's differences, conflict over issues is substantive and

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not emotional, consensus is reached through rational discussion and an evaluation process, and members are able to accept their own involvement and other aspects of the group process without alarm. These changes also create a deeper understanding of how other persons feel, think, and behave, and it is the catalytic role of unconflicted members which represents the power to move the group. By the introduction also of "barometric events," e.g., removal of the trainer to help resolve dependence and the evaluation-grading requirements at the termination of the course, provisions are made for the catalytic agents and resulting process to occur. Additional data and experiences are necessary to establish the influences of these action-producing events.

Tuckman (1965) reviewed 50 articles dealing with the developmental sequence in small groups for three different settings, i.e., therapy-group studies, T-group studies, and natural- and laboratory-group studies, and two stages of group development, i.e., interpersonal relationships (group structure) and task activity. Tuckman proposed a conceptual model as a set of hypotheses of changes in group behavior in both social and task realms across all groups over time. The model took the following form:

| Stage | Group Structure | Task Activity |
|-------|-----------------|---------------|
| 1 | testing and dependence | orientation to the task |
| 2 | intra-group conflict | emotional response to task demands |
| 3 | development of group cohesion | open exchange of relevant interpretations |
| 4 | functional role-relatedness | emergence of solutions |

From a detailed analysis of the studies selected for
review in terms of the above structure, Tuckman summarizes
the developmental model proposed in terms of four stages:
forming, storming, norming and performing (pp.397-398).
In the forming stage the group initially concentrates on
orientation and testing to identify boundaries of both
interpersonal and task behaviors.  Also dependency rela-
tionships with leaders and co-workers or preexisting
standards are established.  The second or storming stage is
characterized by conflict and polarization around inter-
personal issues, and emotional responses in the task situa-
tion.  These behaviors serve as resistance to group influence
and task requirements.  During the norming stage, ingroup
feeling , cohesiveness, new roles and new standards evolve,
and intimate, personal opinions are expressed.  In the
final stage, i.e., performing, the interpersonal structure
becomes the "tool of task activities."  As a result of
roles becoming flexible and functional, group energy is
channeled into task activities, and, with structure issues
unsolved, structure becomes supportive of task performance.

Tuckman believes that the studies reviewed are sugges-
tive although the available data cannot substantiate the
above model.  Particularly the studies do not deal with rate
of temporal change, permit calculations for rate of change
for each stage, or systematically study the effects of a
variety of independent variables on development.  The model
may, however, provide a framework for investigating these
elements which do relate to team operations and team perfor-
mance needs.

Most definitions of groups and teams include the con-
cept of goal directed behavior.  Zander's (1968, 1971)

theoretical orientation encompasses group goals and group
motives as distinct from individual member goals and motives.
His investigations place emphasis on members' plans or
actions "in behalf of the whole group regardless of personal
gain to be received from participation in the group's work."
Also, working groups are considered to be more likely to
be more effective when they have a clear criterion of success
since this type of goal helps members to define the members'
tasks, coordinate their actions, and develop efficient work
procedures. According to Zander, group member's awareness
of accomplishment and feelings of satisfaction give rise to
several useful group properties such as a stronger desire
for group success, increased level of effort, more effective
coordination, less strain in interpersonal relations, and
greater member attraction. This focus on group level of
aspiration as a particular kind of goal takes into account
both the conditions of the group and individual motives.
Some of the conditions which might influence individual
member's choice of a future goal for an operating group in-
clude selection of the performance level that can be reason-
ably attained, satisfaction associated with various levels
of group achievement, influence of externally-developed
information about the group's future, variations in the
members' strength of desire for group success, and personal
dispositions toward group membership and participation in
developing group goals. The nature of the goal itself can
also determine the events which occur within a group, i.e.,
levels of performance, members' pride and commitment, atti-
tudes and beliefs, and the contamination of the group. Both
aspects of group motives and aspirations are included in
Zander's theoretical orientations.

What little research support exists for Zander's theoretical and methodological approaches results from studies in group dynamics rather than group decision-making or problem solving, and to some degree from studies in "risk taking." Study results on the nature of cooperation, cohesiveness and group performance in dynamic groups are suggestive. Zander could find little descriptive data or relevant theory relating to the origin of group goals and the interest of members in these goals (Zander, 1971; p.4). The working assumptions Zander employed to investigate how a group develops its future expectation included:

1. the ends that members select for their group are part of the unit's ongoing work procedures, subject to change as a result of feedback on group performance. The feedback model stresses the importance of the relationship between performance achieved and what is desired, and the involvement of motivated behavior.

2. to accommodate the presence of individual behavior in group decisions and activities, four sets of relationships need to be considered including (a) members's goal for the group, (b) group's goals, (c) group's goal for a member, and (d) member's goal for self, which are concepts about an individual and are properties of the group.

3. most important, group level of aspiration is a suitable type of goal for initial study, assuming that a group aspiration may be conceived as an analogy of a personal aspiration.

4. Group level of aspiration is defined as
   the "score members expect their group will
   attain in the future." The rationale for
   deciding upon this working assumption
   include (a) the origin and changes in
   level of aspiration give operational mean-
   ing to the stages of the feedback model
   above, (b) a fairly standardized procedure
   exists for studying the level of aspira-
   tion and related concepts, (c) evidence
   is available that a group can influence
   a member's personal aspiration by
   establishing a group level of aspiration,
   and (d) findings from previous research
   on individual aspiration provide a way
   of judging intuitively if groups, when
   they set their goals, differ in some
   way from individuals, when they set their
   goals.

The concept of group achievement motivation is based
upon research by Atkinson and Feather (1966) and McClelland
(1961, 1965). The "need to achieve" experimental research
focused the need on the achievement of the group by limit-
ing the feedback to information on group performance.
Investigation of the focus on group versus personal success
was encouraged by McClelland's work on achieving societies.

Zander (1971, pp.176-198) ordered the findings relating
his efforts and that of others to provide a theoretical
framework for explaining why aspiration processes function
as they do. The structure for the ordering took the form

of assumptions and hypotheses presented under the below-
listed topical headings within each of which four kinds of
results are discussed:

| Topical Headings | Kinds of Results |
|---|---|
| 1. sources and functions of a group level of aspiration | 1. placement of a group's level of aspiration |
| 2. effects of group success and failure | 2. motivated beliefs of members |
| 3. reactions to social pressures arising outside the group | 3. evaluation of performance |
| 4. group-oriented motives | 4. performance of the group |
| 5. person-oriented motives | |
| 6. group's aspiration | |

Zander (1971, 1968) has been able to demonstrate that
a variety of conditions contribute to the improvement of
group performance including arousal of members to possess
a high degree to desire for group success, increasing goals
higher than past levels of successful performance, providing
feedback on group scores as well as individual scores,
enhancement of group performance due to increasing difficulty
of the task affects those oriented toward group needs whereas
feedback arouses those with strong personal motives. The
congruence between a member's goal and the group's require-
ment is greater if the member's task is more relevant to the
work of the group, the group presses the member more strongly
to perform at a particular level, the goal is a moderate
challenge, and the social pressures are noncoercive.

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Hare's (1976) conceptual scheme for the analysis of human interaction is relevant to resolution of issues related to the definition and analysis of a team. Hare considers interaction of members the distinguishing characteristic of a group versus a collection of individuals. Citing the work of several researchers, he identifies four features of group life in addition to interaction which typically emerge as a collection of individuals develops into a group. These are: (1) members share one or more motives or goals which determine the direction of the group, (2) members develop a set of norms which set boundaries for interpersonal relations and activities, (3) a set of roles becomes stabilized as interaction continues and the group becomes differentiated from other groups, and (4) a network of interpersonal attraction develops among members (Hare 1976, p.5).

This set of characteristics can be compared to the minimum set from Hall and Rizzo (1975) developed as a consensus from a sampling of various authors' definitions: (1) be goal- or mission-oriented, (2) have a formal structure, (3) have assigned roles, and (4) require interaction among members. These authors emphasize that a decision as to whether team training should be given to a particular group of individuals should be based upon criteria applied within this framework. Recognizing the similarity between the small group and team training characteristics, it appears desirable to examine the methodology of Hare's conceptual scheme for its potential use in increasing our understanding about fundamental issues in teams and team training.

The basic elements of Hare's scheme are man's biological nature and personality and his environment, with interactive behavior as a compromise between the needs of the individual and the demands of the environment.  The relationship of the elements affecting the interaction of group members may be examined from the point of view of process, structure, or change.  Process involves the analysis of act-by-act sequence of events over time.  Structure involves the same analysis at a point in time.  Social change typically focuses on changes in the structure of a group over time.  The categories of behavior suggested for interaction analysis are interpersonal (e.g., cooperative problem solving), intrapersonal which includes individual performance as well as tension and anxiety.  Two categories described for representing the major dimensions of observed behavior are form (e.g., communication network) and context (task behavior) which also include provision for input and output characteristics.  The analysis can be applied to behavior, personality and role.  Both formal and informal structures are considered.  Group members must solve problems at both the group level and the individual level, at which there are both task problems and social integration problems.  Satisfaction of own goals prior to participating in group organization and tasks is the usual case.  Conformity to norms is necessary to solve problems at all levels.  Groups must meet four basic needs in order to survive:  (1) L - share a common identity and possess a commitment to the values of the group, (2) A - possess or be able to generate necessary skills and resources to reach the group goal, (3) I - have rules for coordinating activity and enough feeling of solidarity to stay together to complete the tasks, and (4) G - provide sufficient leadership and

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control to be effective in reaching their goal. Groups usually develop in the order of the above phases (Hare 1976, pp.16-17).

Hare's emphasizes the importance of the task as the most general way of specifying the expectations for group behavior. The task of the group in the broadest sense is to deal with the situation in which it finds itself. Tasks are described in terms of six variables: (1) kind of task (goal), (2) criteria for task completion, (3) rules (or roles) which must be followed, (4) method for imposing rules, (5) amount of stress on members, and (6) consequences of success or failure (Hare 1976, p.258). This concept of task can be contrasted with the classic concept of task reflected in Miller's definition as quoted in Meister (1976, p.96): "A task is a group of discriminations, decisions, and effector activities related to each other by temporal proximity, immediate purpose and a common man-machine output." What Hare's concept suggests, as do other related concepts of tasks, is that the classic concept of task and the related methodology of task analysis may be the most limiting constraints in efforts to develop an operationally-usable definition of a team. Perhaps the conclusion by Meister (1976, p.151) that "very little information is available about how tasks are performed in the real world context" should not be interpreted as meaning tasks as classically defined but rather as tasks whose characteristics and dimensions transcend the narrow concept of man-machine interaction and encompass much more of the total environment.

Steiner (1972) sets forth a group productivity theory, "modest in scope," stressing the integrative role of task

demands and group process. The basic formulation centers
on the manner in which task demands specify the need for
and use of resources, the adequacy of resources determines
the potential (maximum) productivity, and the appropriate-
ness of processes determine the degree to which actual
productivity approximates potential productivity. To
further elaborate on this formulation, Steiner presents a
partial typology of tasks which includes divisible versus
unitary tasks, maximizing versus optimizing tasks, tasks
which permit members to combine their individual products
(disjunctive, conjunctive, additive, and discretionary
tasks), and tasks which prescribe the process to be employed
as well as those which are permitted. In a disjunctive task
the group can accept only one individual's contribution as
the group's own; in a conjunctive task the rules rather than
the group dictate selection of the individual who is the
worst performer. An example of the latter is the speed
with which mountain climbing speed is influenced by the
slowest member. Additive tasks are group determined, i.e.,
combination of individual contributions equally-weighted.
Discretionary tasks permit the group to select its own pro-
cess for combining individual contributions.

Steiner (1972, pp.40-66) describes options in specifying
the division of tasks into subtasks and the matching of
specified-unspecified division of tasks and specified-
unspecified matching of individuals and subtasks for divisible
tasks. In the majority of cases of combining several sub-
task outcomes into a group product, the process is likely
to be disjunctive, and in real life, the integrative process
is performed by the group to develop a complex product. When
division and matching are specified, actual productivity will
fall below potential productivity when members fail to perform

up to the limit of their resources within their assigned roles. In the unspecified case, the group must make organizational decisions as to who will do what, and actual productivity will be heavily influenced by the system of matching and specifying selected.

Throughout the exposition of his theory Steiner emphasizes the importance of process and the dependence of prescribed process upon the nature of the task and the size and composition of the group which permit us to specify who should do what and when in order to be productive. Use of suitable payoff systems helps to motivate members to perform their role more effectively in the prescribed process. Steiner stresses the concept of the group as a system and the view that "process is the essential bond by which members are held together in relationships that impart a quality of wholeness to the group. A group cannot be productive for very long unless it survives as a system, and survival requires that the group cope with its environment" (p.185). Steiner concludes by noting that the most troublesome unanswered questions concern the goals which group action should be directed rather than the manner in which it can be directed.

Hackman and Morris (1975, p.46) conclude from their comprehensive review that in spite of the thousands of studies of group performance conducted over the past several decades, little is known about why some groups are more effective than others, and even less is known about what to do to improve the performance of a given group working on a specific task. The main thrust of their approach for understanding group effectiveness is on the role of the interaction process and explicit quantitative assessment of how group interaction affects group performance. In reviewing several conceptual

approaches to understanding group processes, which Hackman
and Morris refer to as speculations, they identify the
"pessimistic" view of Steiner who addresses process losses;
the improvement in quality of solutions, i.e., freedom from
error, stemming from the interactions among group members;
the negative effects of "groupthink," that interaction can
sometimes result in "assembly effect bonuses," and the
views of organizational psychologists from their work with
experiential training groups or with team building activ-
ities (p.48).  The authors point out that "there are sub-
stantial data which show that training activities can power-
fully affect both the nature of the interaction process in
groups and the quality of members' personal experiences.
But the few studies that have tested the effects of such
changes on actual task performance generally have yielded
ambiguous or negative results (for reviews see Herold,
1974; Kaplan, 1973) (Hackman and Morris 1975, p. 49).

Hackman and Morris, using a paradigm adapted from
McGrath (1964, p.49), present an organizing framework for
examining the relationships among the initial state of a
task-oriented group, the group interaction process, and the
group's ultimate performance effectiveness.  Interaction
process is defined as all observable interpersonal behavior
that occurs between two arbitrary points in time $(t_1 - t_2)$.
The concept specifies that the state of all system variables
may be assessed at any given "slice" in time and the input-
output relationships may be examined for short or prolonged
periods of time.  The underlying assumption is that the
variations in group performance can be identified by a
careful analysis of the interaction process which mediates
between input and output.

The authors cite research evidence from studies which deal with input-process relationships, process-performance relationships, and the full input-process-performance sequence. Numerous input factors have been identified as affecting group interaction including leader attitudes, member personality characteristics, group history or experience, group structure, and particularly the nature of the task. Hackman and Morris report that little research has been conducted on the relationship of group process characteristics to performance outcomes. Earlier laboratory research of Lanzetta and Roby (1960) found that measures of group interaction predicted task performance better than measures of task relevant knowledge and training procedures. The way the group uses its resources and the procedures it employs were found to be at least as important as knowledge of the problem. The previously described research of Steiner (1972) has suggested that this process can be systematically investigated through a weighting approach for selecting or rejecting group members solutions.

In an attempt to provide supporting evidence for the hypothesis that group interaction mediated input-performance relationships, Hackman and Morris investigated the input-process-performance sequence using intellective tasks classified as production, discussion and problem solving tasks. The findings from these studies, and other reviewed by the authors, indicate that group processes are strongly related to group performance outcome as reflected in statistically reliable relationships but there is little understanding of the substantive aspects of the input-process-performance relationships.

Hackman and Morris (1975, pp.56-61) describe several methodological and conceptual limitations of research which account for the failure to demonstrate how group interaction process mediates between input and output states. These include (1) inadequate interaction coding systems which do not contain any conceptual or operational link between the behaviors measured and the determinants of group effectiveness, (2) failure to directly relate interaction sequences to the task goals and strategies being pursued by group members, and to develop procedures for longitudinal study of groups larger than dyads, (3) need to deal with inconsistent relationships between group process and group performance for different types of tasks, (4) limitations of research setting, e.g., laboratories, which hold as constant variables which are known to have important influence on interpersonal behavior, and (5) conservative strategies for investigating the cultural norms which effect group behavior.

Hackman and Morris (1975, p.61) propose a three pronged research approach to group effectiveness involving the functions of the interaction process, recasting the role of input factors, and experimentally creating nontraditional structures and process. With regard to the functions of the interaction process, three summary variables are proposed for controlling the variation in measured group performance thereby making the management of the large number of input variable feasible.. The three summary variables are: (1) effort brought to bear on the task by group members, (2) task performance strategies used by group members, and (3) knowledge and skills employed by group members. Group interaction is viewed as affecting effort primary through the coordination of efforts of individual group members, and by affecting the

level of effort group members expect (task motivation).
Performance strategies are defined as more than procedures;
they involve collective choices about how members go about
performing the task "and desirable performance outcomes."
The interaction process can affect performance strategies
by fostering the implementation of strategies shared by
group members, facilitating the reformulation of shared
strategies, or developing new ones. In the area of knowledge
and skills application, interaction processes function in
assessing and weighting the differential contributions of
group members and in creating conditions within the group
to optimize the use of all knowledge and skill available.
These influences may be particularly important in preventing
significant "process losses" due to inadequate interaction
processes, and more importantly produce "process gains"
associated with each of the summary variables.

The second thrust of the Hackman and Morris interaction
process approach involves the manipulation of certain input
factors to improve the level of group effectiveness than
might ordinarily be expected from the contributions of the
summary variables. The specific input factors selected are
the structure of the norms which guide member behavior,
the design of the group task, and the composition of the
group, i.e., characteristics and histories of group members.
More specifically, Hackman and Morris are proposing that
performance strategies can be made more task-appropriate by
modification of group norms, the level of member effort can
be increased by task design, and group knowledge and skill
levels and application can be improved by manipulating group
composition.

The third element in the proposal by these authors is

research on experimentally creating nontraditional structures and processes effecting group effectiveness. Noting that this area has received almost no systematic investigation, Hackman and Morris (1975, pp.84-87) report on one study involving three intervention conditions relating to planning strategies (strategy, antistrategy, control), and exhortation or absence thereof, four-persons groups, and two-task conditions (unequal information and equal information). The results indicate that the strategy intervention (first a preliminary task then the primary task) did successfully alter the interaction process of the experimental groups. Another important finding was that the control groups did not discuss strategy spontaneously suggesting the need for training in strategy utilization. Members of the strategy intervention groups showed more interpersonal problems but also greater flexibility in their task approach in changing procedures when needed to improve performance. Members of these groups also perceived themselves as high in leadership and influence, unlike the members of the other two groups, which Hackman and Morris suggest reflects the creation of a condition of participative leadership. The authors conclude that this research suggests that it is possible to create new, nontraditional norms in groups, to trace their effects on group effectiveness, to affect the group interaction process through interventions, and these changes lead to measurable differences in productivity.

In summary, Hackman and Morris propose that group interaction process is a major determinant of group productivity, that some selected "input" variables significantly influence group performances and can be manipulated to bring about desired results, and that three "summary variables" (effort, performance strategies, knowledge and skill) summarize the

most powerful proximal causes of group effectiveness.
The general strategy suggested for achieving progress in
understanding and managing these various group influences
is by development of smaller theories specific to elements
of the performance process or to performance effectiveness
under specific circumstances (Hackman and Morris 1975, p.88).

Davis (1969) set forth a theory of group performance
with emphasis on social interaction and combinatorial
processes involving individual preferences. Social inter-
action "implies that the behavior of one person is in turn
a stimulus as part of a stimulus complex for the behavior
of a second." Davis views group behavior as a function of
three classes of variables: person variables, environmental
variables, and task or goal associated variables. Further,
the focus on group performance is on group product, group
structure and group process about which he believes "any
attempt to segregate overlapping and continuous phenomena
rests on uncertain ground" (p.5). The primary question for
Davis is how individual task-oriented behaviors are weighted,
combined or whatever in order to produce a distinct group
product. Central to his theory is the development of
theoretical baselines against which real group performance
can be compared. By use of this normative approach, Davis
believes an adequate theory of group performance for some
situations can be approached more quickly. Baselines are
conceptualized as social combination schemes for translating
members contribution to the task into a group product. One
example cited by Davis (p.44) is identifiable as an average,
as in Stroop's discussion of group judgments in comparison
with judgment of the average member of the group. A
variety of other schemes have been put forth for pooling
member contributions in judging, problem solving and learning

tasks (e.g., Taylor, 1955; Lorge and Solomon, 1955; Hoppe, 1962; Steiner, 1966; Laughlin et al., 1968; Zajonc and Smoke, 1959; and Taylor, Berry and Block, 1958). The general conclusion from examining these approaches is that "the direct performance advantage displayed by groups has a rather simple explanation in a number of cases. More precisely, there exists a simple pooling hypothesis concerning member products that is at least sufficient to explain a rather wide range of group-individual results on decision-making, problem solving, and learning tasks. However, the model developed by Taylor and by Lorge and Solomon does not explain all group performance. It has frequently overpredicted group performance, and this deviation remains to be explained in many cases. Furthermore, many different kinds of groups have not been studied in this individual-into-group manner, and hence their performance cannot be considered in light of this or other social combination hypotheses. The task and other circumstances frequently do not permit either empirical or mathematical construction of concocted groups" (Davis 1969, p.47).

Davis (1973) proposes a general theory of social decision schemes aimed at accounting for the distribution of group decisions by using formal hypotheses about the effects of social interaction when the inputs are individual member preferences. Davis distinguishes group problem solving as emphasizing the processing of information to construct response alternatives to fit specifications laid out in the stem of the problem from decision-making as emphasizing the selection of a response from a set of mutually exclusive and exhaustive alternatives. The concern in both cases is with the social interaction processes, i.e., combinatorial processes, which in problem

solving are termed social combination process and in decision-making are termed social decision schemes. The model proposed is a transformation of the probability distribution characterizing individual differences to a group distribution over the same alternatives. Davis' considers this individual-into-group model similar to Steiner's (1972) group productivity model as well as other waiting time and group dicision models, except that he considers his model to be a general case model extending to any n and r. To quote Davis (pp.123-124) "the formal derivation herein led to an extremely simple expression that permitted a very convenient representation of (the social decision matrix, D) the hypothetical social process leading to a decision. The matrix form of the social decision schemes to be transformed into precise predictions about group decision, but might even be thought of as a "picture" of the task social system that has at least some interpretation by direct inspection." The social decision matrix is focused on tasks or problems that require a sequence of choices, and developing estimates to fit this matrix may provide a direct estimate of that which may be difficult or impossible to observe directly. The viability of assumption that the social decision scheme remains con-stant for some set of trials, time intervals, or items must be demonstrated to determine the validity of the estimation procedure. Davis' research has included exploring various distributions (positively skewed, bimodal, symmetrical, and uniform) and social-decision schemes, equiprobability, majority with a proportionality subscheme, and averaging.

As previously noted one of the fundamental issues relating to groups and teams is that of defining group or in ways that are meaningful both theoretically and

operationally.  As Hall and Rizzo (1975) emphasize, failure
to develop the concept of team limits greatly progress in
team training and team performance.  The following discussion
of theory and definitions of "group" relates not only to the
foregoing substantive areas but also to the applied problems
of teams.  As such it provides some new insights and poten-
tial sources of new approaches for investigating the concept
and definition of teams.

Smith (1967) reviewed much of the theoretical literature
on the theory of the group and definitions used by various
scholars in the field.  Integrating the research relating to
the definition of group, he proposed a definition to
"simultaneously optimize the evaluative criteria of parsimony,
conceptual clarity, and scientific utility."  Smith's defi-
nition includes "(1) the largest of two sets of two or more
individuals jointly characterized by (2) a network of rele-
vant communications, (3) a shared sense of collective
identity, and (4) one or more shared goal dispositions
with associated normative strength" (p.141).  One objective
of this definition is to overcome the previous limitations
of definitions which have been too broad or too narrow
thereby ignoring the distinctive, emergent structural
properties of groups.  The first element, group size, is
intended to be inclusive of every individual in space-
time who satisfies the definitional criteria.  The second
element, network of communications, requires that each
member has received at least one communication relevant to
the existence and purposes of a particular collective unit,
and that each member of a set is connected with every other
member by a finite number of relevant communication links.
No specifications regarding time period, means of
communication, or originator of the message are involved.

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Relevant information relates to the flow of information
about the existence, purposes, norms, etc. of character-
istics of a collective entity. By collective entity is
meant the abstract image of a group or group-like phenomena.
Accordingly, two defining characteristics of a group are
that every member received information at least once which
dealt with the existence and main goal of the group, and
a finite number of communication links be identified
between a given member and any other member.

The third element, a shared sense of collective
identity, involves an observable condition in which each
member perceives himself to be member of or participant
in some specific collective entity and believes that others
exist who share this same perception, that is a belief in
mutual membership and in unity, an intellectual rather than
emotional commitment. An emotional commitment is a
variable rather than a defining characteristic.

The fourth element, shared goal disposition, is the
tendency to want or prefer some end-state or configuration
of events, which is recognized reciprocally by each member.
Associated normative strength is the sense of rightness or
sense of social duty to accomplish the share goal. This
involves the requirement to have at least one norm present,
that of accomplishing the goal. The main shared goal is
mutual interaction rather than some specific set of
instrumental actions although these are necessary for
preserving continuity of identity.

The above definition of group is considered by Smith
to be of maximum use because its elements represent a
"critical mass" in a real empirical sense. This means

that there should be a sharp increase in the probability
that grouplike phenomena will occur once observable con-
figurations of events satisfy the four definitional require-
ments. Grouplike phenomena are concerted self-conscious
and other conscious thoughts, feelings or actions on the
part of a set of individuals (Smith 1967, p.150). By know-
ing that several individuals form a set and knowing the
global nature of the group goals, norms, roles, etc. the
total variance in behavior may be predicted to some signifi-
cant degree without having additional information available
about each member. Groups structure their behavior in such
a way that it is more predictable than generally is the
case for an equal member of individuals not forming a group.
This group structuring is termed "supraindividual pattern-
ing of behavior" (Smith 1967, p.150). The increased pre-
dictability occurs not only in current but also future
behavior. Once formed the group tends to have a future of
its own distinct from that of individual members. Pursuit
of common goals results in development of a variety of
mutually supporting grouplike phenomena such as normative
strategies for goal implementation and formation of group
representatives and interaction. Grouplike phenomena are
sequences of highly interrelated event configurations which
at any point in time are systematically and probabilisti-
cally related to future grouplike phenomena within the
same set. "The explication of grouplike phenomena may be
further refined by stating that the emergent grouplike
phenomena are complex events that not only manifest a
predictable supraindividual patterning of the present and
future behavior of multiple individuals but which also
permit such increased predictability without primary
dependence on sheer physiological-genetic causation or on
the coercion of external environmental factors" (p.151).

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To provide the empirical referent for the term group, the idea of self-conscious unity among members who manifest hightened predictability is added which can be used to distinguish groups from non-groups. The results of these considerations provide an external criterion for the scientific utility of any definition of group.

Smith also identifies internal evaluative criteria for the definition of group which refer to the connotation or inherent logical structure and content of a definition (p.153). The definition should include only as many elements as are necessary to denote the phenomena of interest and no more (parsimony), and should be precise and operational by providing clearcut rules for application of certain of its component terms to real world observable events, and clearly defining all of its component terms (p.154).

Each of the four elements of the definition, group size, communication network, shared collective identity and shared goal disposition are evaluated by Smith in terms of the criteria above. The results are summarized below and are shown to be elements of a definition of group necessary for the emergence of grouplike phenomena. Reading "group" as team provides some insight into their potential for use in satisfying the fundamental requirements for a theory based and operationally-usable definition of team.

1. group size   -   when two or more individuals satisfy the stated criteria for membership, a group exists; groups include all members - past-present-and future; a larger number of emergent group-like phenomena occurs as group size increases; groups are dynamic and continually changing in nature

| 2. communications -<br>network | similar patterns of learning, necessary for predictability of group-like phenomena, develop through communications which must meet the criteria of relevancy; i.e., relevant to the defining elements - collective identity, shared goals, etc.; neither direct nor face-to-face, nor two-way communication are necessary since grouplike phenomena emerge from much simpler networks |
| --- | --- |
| 3. shared collec- -<br>tive identity | a shared sense of identity unity is essential for concerted, conscious grouplike phenomena to occur with any degree of regularity; this is the cohesive force which distinguishes the group from a collection of individuals |
| 4. shared goal -<br>dispositions | one or more shared goal dispositions with associated normative strength must be present; role differentiation, patterned actions by members, development of group actions and group representatives, growth of norms and the like can emerge only if the motivational and instrumental unity necessary is provided by this element; shared goal disposition is all critical to regularity of behavior; the normative strength portion provides the cohesiveness that goes beyond self-interest in achieving shared goal disposition |

In addition to the question of necessary conditions for the emergence of grouplike phenomena, Smith also considered the matter of sufficiency (parsimony) in terms of several other analytic aspects of groups.  The results of his assessment are summarized as follows:

1. face-to-face interaction - generally considered relevant for defining small groups rather than groups in general

2. norms regarding means - except for one norm related to shared goal disposition not necessary for formation of a group and not necessary for defining a group; norms concerning means develop over time

3. role differentiation - defined as differential task allocation, this is not necessary for defining a group; if role differentiation is negligible, so is functional interdependence

4. action - possible for groups to exist at a level of shared thought, feelings and goal disposition without overt actions

| | | |
|---|---|---|
| 5. duration | – | contrary to views of Bogardus and Verdú, Smith asserts that endurance through time is not a defining element of a group |
| 6. external perception of group identity and group membership | – | being perceived by nongroup members as having essential group elements not necessary; this is a variable characteristic of groups; other researchers argue the contrary view |
| 7. socioemotional pattern | – | these are variables rather than defining characteristics for all groups |
| 8. mutual and satisfaction | – | necessity cannot be demonstrated although it is a frequent occurrence; Bates and Bobchuk, Hare, Williams disagree |
| 9. intergroup relations and group representative roles | – | not necessary for the emergence of grouplike phenomena; occurs after the emergence of a group |

Smith notes that his four definitional elements, as well as those discarded above, yield dimensions, and their long-term value lies in serving as crucial dimensions. Further Smith states (p.164): "Thus it becomes an empirical question whether and to what extent groups are characerized by face-to-

face interaction, by norms guiding group goal accomplishment, by endurance through time, by a collective identity perceived by outsiders, by role differentiation and functional interdependence in the accomplishment of tasks, by positive interpersonal choices among the members, by the provision of various sorts of satisfactions to the members, by overt action, by representative roles, or by other characteristics which have not even been considered here. All of these characeristics may be seen as forming a property space of important elements of groups, so the general scientific problem to be faced is to explain movement through this property space in a systematic way." Smith also emphasizes that having a precise definition of groups permits the conduct of much needed research such as prevalence rates and determinants of rates for all kinds of groups, determination of number of groups and sampling of groups rather than sampling group members, group formation and rate of group formation, and group development, growth and change, and general social theory. The critical aspect of Smith's approach, i.e., the strategy of "focusing on emergent group-like (team) phenomena and building a construct suitable for denoting this empirical reality" seems particularly applicable to the requirements of teams, team training and team performance. The need for advances on both theoretical and empirical levels has long been recognized. For example, Lorge et al. (1958) reviewed the literature on group performance in problem solving, noting the various and often artificial definitions of "groups" (statisticized, climatized, concocted, ad hoc and traditional) and cautioning against generalizing principles developed for specific groups until underlying assumptions relating to each group were validated.

This section of the report has examined developments and trends in theories and methodologies in both team training and small group behavior research. Few recent advances or research projects in team training have been identified. Team training concepts appear to be heavily influenced by unconfirmed findings such as that individual proficiency achieved in training is the keystone to required team performance. In contrast, the review of the small group behavior research literature indicates an increasingly large number of publications. A multitude of potential contributions are described for developing new team, team training and team performance concepts, and employing more sophisticated research strategies. Theoretical and methodological contributions are available from several substantive areas such as experiential learning, group productivity, group growth and development, group interaction analysis, and group theory and definition. These developments are discussed in terms of potential contributions to resolving basic questions relating to team concepts, growth and development of teams as units, analysis of team tasks and performance, and associated team training strategy requirements, particularly an Instructional System Development model for teams.

## 4.0 FINDINGS ON SUBSTANTIVE VARIABLES

### 4.1 Introduction

This section of the report addresses substantive findings from research in the team training and small group behavior areas including group performance. The objectives are to review these findings and to determine what relationships might exist across disciplines in terms of variables associated with the two previously-discussed elements of the instruction system development model, i.e., development of training requirements and operational evaluation of training. The former element requirements are viewed principally in terms of team definition, analysis and development concepts. The second element requirements are examined in terms of team performance and operational evaluation of training.

The organization of this section focuses first on findings from team training research and then on small group behavior similar to the organization of the preceding section covering theory and methodology. Efforts were made to prepare a matrix composed of team training and small group behavior findings using the ISD structure (Table 1, p.24) and Altman and McGrath's (1966, pp.104-105) classification scheme. This approach was found not to be feasible for several reasons, particularly the wide variations in definition of terms and experimental designs. A detailed descriptive analysis was conducted to identify suggestive relationships which offer opportunities for further development and potential operational applications to team training and team performance.

## 4.2 Team Training

Briggs and Johnston (1967) reviewed and summarized team training research, including their own series of ten laboratory investigations conducted during the period 1963-1967. Findings are discussed in terms of (1) task variables, (2) training variables, and (3) communication variables. From their review and synthesis, these authors developed suggested principles of system design and training, which are often quoted in the literature. Several difficulties associated with these principles need to be considered. Some of the difficulties are: (1) almost all of the research findings are from laboratory investigations, (2) the principles are not relatable to a team training theoretical foundation, (3) although presented as "suggestive," the principles have not been systematically tested, and (4) contradictory evidence has developed since 1967, e.g., Klaus and Glaser (1970) findings of decrements in performance under a parallel structure as a result of the redundancy which produces interference between skilled and less skilled workers.

Perhaps what has been lost sight of in the publicizing of these suggested principles is the following quotation from Briggs and Johnston (1967, p.25):

"But can we now conclude that individual training is superior or at least not inferior to team training? We hesitate to do so for there still are those real-life training situations, and obviously, intelligent system managers do not spend funds for team training when such is not necessary. Further, the RAND-System Development Corporation research on team training (Chapman et al., 1959) has produced some interesting and persuasive theory (Kennedy, 1962), and we hesitate to reject that long-term program and its basic assumption that team training is necessary.

Perhaps the answer lies not so much along a coordination dimension, as we assumed in designing the tasks for Experiments II and V, but conceivably the dimensions of system complexity and input complexity and uncertainty more directly determine

TABLE 2 - VARIABLES REPORTED ON BY BRIGGS & JOHNSTON (1967)

| Task Variables | Training Variables | Communication Variables |
|---|---|---|
| 1. task organization/ structure | 1. task fidelity | 1. verbal communications |
|    a. centralization |    a. equipment/ procedures |    a. content analysis |
|    b. parallel vs. serial |    b. skill requirements | 2. team interaction |
|    c. team organization |    c. input fidelity | 3. team proficiency |
| |    d. output fidelity | 4. time |
| 2. system load | 2. performance feedback effects | 5. coordination |
|    a. systematic variation |    a. intrinsic KOR | 6. communication discipline |
|    b. load balancing |    b. extrinsic KOR | 7. information channels |
|    c. load and training |    c. information content EKOR | 8. interoperator behavior |
| |    d. complex feedback | 9. reciprocal/ nonreciprocal |
| 3. operating procedures | 3. individual vs. team training | 10. appropriate/ nonappropriate feedback |
|    a. flexibility |    a. team member replacement | 11. stress conditions |
|    b. procedural planning |    b. previously working together | 12. communication and team performance |
| |    c. training received as individual vs. training as a team |    a. amount |
| |    d. team coordination |    b. types |
| |    c. system complexity input complexity and uncertainty | |
| | 4. operator replacement | |

whether individual or team training is the more efficient training procedure. Certainly, full-scale air traffic control operations and an air defense system such as SAGE are complex, and the total input to these systems is considerably more variable and less precisely sensed than were the inputs to the radar control tasks utilized in the present series or the coded inputs in the Horrocks et al. studies. Under these levels of complexity and input uncertainty the basic concepts proposed by Kennedy (1962) all argue strongly for team training; one cannot develop a system awareness, an integrated model of the (complex) environment, or exploit fully the self-organizing capability of large teams without team training.

Therefore, we do conclude that highly-skilled team performance in complex systems does require team training. But, we can still ask the question: how much team training relative to individual training? The question has not been the subject of empirical test in truly complex systems. We predict the answer would be most interesting."

The following conclusions were drawn regarding the cited variables in the summary report (Briggs and Johnston, 1977):

1. team structure - a hierarchical structure is more reliable, requires less training and permits an open communication system

   parallel substructures within a hierarchical structure are preferred to serial structures because team performance is less dependent on the least skilled worker and load balancing is more easily carried out

2. interaction - minimum interaction between team members fosters superior team performance

3.  load                    –    teams can learn to adapt
                                 to an increase in load on
                                 the system provided the
                                 operating procedures per-
                                 mit such flexibility

4.  feedback                –    debriefing sessions follow-
                                 ing team training sessions
                                 help through KOR.  Con-
                                 clusions from the literature
                                 include: (a) KOR helps shape
                                 behavior in those team tasks
                                 which contain relatively
                                 little feedback, (b) individ-
                                 ual-specific KOR (rather than
                                 total team KOR) is desirable
                                 when one man to compensate
                                 for the deficiencies of his
                                 teammate(s), (c) KOR must be
                                 controlled rather carefully by
                                 the instructor to meet the
                                 unique needs of different
                                 stages of training, and
                                 (d) teams attempt to maximize
                                 those aspects of performance
                                 about which they receive
                                 specific and simple KOR even
                                 though other aspects of team
                                 performance may suffer in the
                                 process

5.  operator replacement    –    operator replacement can have
                                 a temporary deleterious effect
                                 on team performance especially
                                 if the replacement is less
                                 skilled than the man replaced

6. coordination — intrateam interactions involving verbal communications are an index to the level of team coordination present

7. communications — with training, teams exhibit progressively less volume of communications and the pattern of these messages change as a function of both training and task variables

    1. four general characteristics of communications between members identified relate to: (1) reduction of input uncertainty, (2) evaluation of what is known, (3) examining courses of action, and (4) leadership control messages develop

    2. leadership control results in a discipline on the team in their communications

    3. time stress fosters communication discipline, i.e., fewer communications, more objective information content

    4. availability of information messages in a system markedly influences the content of team communication

5. the volume and con-
   trol of communications
   can be controlled by
   immediate feedback but
   such feedback can pro-
   duce unusual effects
   on performance

6. laboratory research
   on team communications
   indicates that the
   less interoperator
   interaction, the
   better

8. individual vs. team training    - direct evidence for the
                                      superiority of team
                                      training over individual
                                      training does not exist

   The above-cited research by Chapman et al. (1959) investi-
gated the concept of the team as a synthetic organism of which
the members are components.  Rather than limiting the observa-
tions to input-output conditions and then inferring what
transpires between the two, these researchers focused on the
process of adaptation by the team to emergent characteristics
of the environment, emphasizing cognitive aspects of learning.
The development of coordinative skills is stressed as being
essential to team members knowing what to do, when to do it,
and particularly why they should take particular actions.  As
a result each member will not only perform his job effectively
but will facilitate rather than interfere with other team
members.  The concepts which form the foundation of the

development process include an awareness of the total system by each member and the relationship of his task to all other tasks, an understanding of the characteristics and functioning of the environment and the relative importance of various events, and the development of innovations for better organizing and performing team activities.  As Chapman et al. (1959, p.267) write:  "Our research indicates that these are the conditions necessary to promote organizational learning:  clarify the goal, give the organization as a whole experience with tasks of increasing difficulty, and provide immediate knowledge of results."

Some of the specific findings from their investigations of four crews in RAND's Systems Research Laboratory were:

1.  organizational goal   - each of the four crews
                                              (3 USAF and 1 college student)
                                              gradually came to behave as
                                              if it were a real-life situa-
                                              tion becoming deeply involved
                                              with the organization's goal
                                              and its successes and
                                              failures

2.  team skills                  - members of each crew became
                                              an integral unit in which
                                              many interdependencies and
                                              coordination skills developed.
                                              As each crew learned to per-
                                              form more effectively, the
                                              learning showed itself in
                                              procedural short cuts,
                                              reassignment of functions,
                                              and increased motor skills
                                              to do the job faster and more
                                              accurately

3.  feedback    -    "debriefings" following each session
                     were considered crucial to learning
                     and led to improved performance but
                     the content of these discussions
                     could not be related to crew develop-
                     ment

4.  load        -    crews continued to operate very
                     effectively though the task was
                     increased threefold; discrimination
                     of important from unimportant
                     information and development of
                     short cuts occurred

5.  stress      -    stresses from increasing task load
                     (failure stress and discomfort
                     stress) were viewed as positive
                     factors in improving performance


Glanzer (1962) summarized a series of team training
investigations, conducted over a period of years, designed
to identify the structure, functioning and training
problems of Navy operating teams.  Other objectives included
determining the relevance of experimental and social
psychological research on group structure and efficiency to
these requirements, and reducing the critical aspects of
team activity to laboratory proportions.  The direct exam-
ination of operating team structure and activities in terms
of network of interactions or communications involved
measures of interaction, centralization, overloading,
coordination and extra-team input.  The findings on these
variables are summarized as follows:

1.   interactions    -   in the teams studied a member
                         responds to another member
                         only at a given point in the
                         sequence of team actions; the
                         sequence is almost completely
                         fixed; i.e., deterministic
                         not probabilistic

2.   centralization  -   contrary to expectations,
                         although highly centralized
                         with regard to rank and
                         responsibility, teams were
                         not centralized in the commun-
                         ications or interaction sense

3.   overloading     -   problems of overloading of the
                         communications channel or
                         heavy requirements with respect
                         to coordination not found

4.   coordination    -   teams showed successive coordin-
                         ation but not simultaneous
                         coordination

5.   extra-team input -  very little input generated from
                         the general environment or
                         other teams carrying out related
                         work


Glanzer concluded that if team performance can be viewed
as a chain of individual responses, there are several reasons
from an efficiency point of view for minimizing team training.

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Addressing the matter of input requirements as a critical
factor in considering individual vs. team training, Glanzer
states that team training cannot be dispensed with because
all inputs used by team members cannot be specified for use
in individual training.  For example, two special cues are
hard to produce: (1) cues from special aspects of other team
members' activities, such as sounds of other members, and
(2) cues from the entire chain of preceding actions.
Glanzer (p.382) writes, "in summary it was found that the
team is a complex organization of interlocking responses
whose proficiency could theoretically be reduced to the
proficiency of the individual composing it.  The success
of such a reduction, however, would depend on much more
information about teams than is currently available."

With regard to the examination of team training pro-
cedures, several administrative as well as training content
(obsolete equipment, etc.) problems surfaced.  Other problems
noted were absence of satisfactory proficiency measures,
limits of time for testing, and technical deficiency of
measurement approaches.  Error data was collected over a
five month period on a total of 506 exercises from 72
different ships using CIC, ship control and gunnery teams.
Errors were analyzed with respect to frequency of occurrence,
team positions and types of activities involved.  The general
results related to team training procedures were:  (1) error
rates were somewhat higher for higher ranking team members
than for lower ranks, (2) only a small proportion of errors
were corrected within the team, (3) the responsibility for
error correction in most cases was not clear.  The emphasis
on individual team member errors, rather than through any
higher order coordination of personnel, and inefficiency in
correcting these errors, were contrary to initial expecta-
tions.

Glanzer's examination of the experimental and social psychological literature for potential contributions included attempts to set forth a comprehensive set of variables or dimensions to describe groups, techniques of group structure analysis, the relationship of attitudes, perceptions and motivation to group performance, studies of the use of special techniques for the improvement of group performance, studies of the relation of individual proficiency to group performance and studies of communication networks. Two areas selected for review were the group network studies by Lanzetta and Roby and Rosenberg and Hall. Glanzer notes that the Lanzetta and Roby studies touch only tangentially on training, whereas Rosenberg and Hall approach the problem more directly (Hall, 1957; Rosenberg, 1959; Rosenberg, 1960a; Rosenberg, 1960b; Rosenberg and Hall, 1958). These latter authors define structure in terms of information feedback and the composition of feedback. Glanzer believes the findings from these laboratory studies are of less interest than the general approach which involves examining experimentally a central part of the team training process experimentally, and it moves the team training problem into the area of learning theory (Glanzer, p.399). Specifically, Rosenberg and Hall (1960) reduced social interaction to feedback conditions and prepared the way for investigating theoretical needs through learning theory. Glanzer concludes that much of the previous work on groups has been directed at the problems of motivation and organization, and more recent work has directed attention to the mechanics of training the individual within the team setting. He notes also a growing appreciation of the special characteristics of the actual team as opposed to the laboratory discussion group.

Glaser and his associates conducted a series of laboratory studies of team performance and learning theory (reinforcement) during the period 1960-1967 (Klaus and Glaser, 1968; Klaus and Glaser, 1970). Two- to four-man teams learned to respond to stimulus light presentations with lever-pressing responses of

two to four seconds duration.  The emphasis in these studies
was on viewing the team and team products as a whole thereby
providing the opportunity to investigate the effects of
various conditions of team reinforcement on team proficiency.
Subjects were all male, senior high school students paid on
an hourly basis for their participation.  All subjects, both
operators and monitors, received individual pretraining in
the timing skill used as the basic team response.  The theo-
retical framework for the various studies was based on
research which has shown that frequency, pattern and accuracy
of an individual's response can be reliably modified during
training, and the resulting performance levels maintained by
carefully controlling the reinforcing events in the individual's
environment.  Application of similar techniques to affect team
functioning was the objective of these investigations.

1.  reinforcement of   -   group performance curves
    team responses          showed similar learning curve
                            characteristics as individual
                            performance; apparent improve-
                            ment in team performance over
                            time explained by temporary
                            decrement in individual pro-
                            ficiency upon entering team
                            performance reinforcement.
                            (Study 1)

2.  team acquisition   -   team response acquisition,
    and extinction          team response extinction,
                            spontaneous recovery,
                            response reacquisition, and
                            response reextinction as
                            changes in output proficiency
                            were investigated.  Three
                            principal operational con-
                            clusions drawn were:

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"(1) it is feasible to view a working team as a single performing entity, having response features which are directly affected by the feedback from team output; (2) individual practice by team members, under certain conditions, may be ineffective in maintaining subsequent team proficiency when feedback about team performance is withheld; and (3) the initial proficiency decrement that may occur when trainees are transferred from the individual practice condition to team training appears to be a function of the changes in the schedule of reinforcement between the two training conditions." (Study 2)

3. decrements in parallel teams — investigation of the effects of redundancy, i.e., adding a monitor on team performance for parallel teams indicated that reinforcement contingencies set up by the structure of a parallel team can result in a performance decrement after an initial increment in proficiency as a function of continued reinforcement practice. (Study 3)

4. team arrangement   -   the effects of three types of
team arrangement were studied:
(1) series, (2) parallel and
individual (only one member
need respond correctly),
together with various reinforce-
ment contingencies. Initial
proficiency varied significantly
(.01 level) in the order of
parallel, individual, series.
Comparison of change in per-
formance from initial to final
trials during team practice
indicated slight improvement
for series, decline for parallel,
and slight increase for
critical members of the individ-
ual teams. (Study 4)

5. team composition   -   proficiency of individual
   and membership          members, ability of members,
delay in initiation of team
training, and team structure
were studied using a series team
arrangement. The principal
finding was that differences in
team learning can be specif-
ically related to the pro-
ficiency which the individual
team member attained during
individual pretraining. (Study 5)

6. supplementary    – investigated the effect of
   reinforcement       furnishing supplementary
                       individual reinforcement early
                       in team response acquisition
                       training, recognizing the
                       sensitivity of change from
                       continuous individual rein-
                       forcement to intermittent
                       reinforcement produced by a
                       series team arrangement during
                       the early course of team train-
                       ing.  Results indicate that the
                       combined use of team and
                       individual reinforcement led to
                       more rapid development of team
                       proficiency, and that the facil-
                       itating effect of individual
                       reinforcement was lost when this
                       added feedback was no longer
                       provided. (Study 6)

7. team environment – investigated team environment
   simulation          simulation through study of the
                       effect of a change in reinforce-
                       ment schedules in going from
                       individual to team training, and
                       to investigate the decrement in
                       proficiency induced by a change
                       in reinforcement schedules (lean,
                       full intermittent, continuous)
                       and three cuing conditions (full,
                       delayed, none).  Results indi-
                       cated that what is actually
                       observed in team performance can
                       be explained by the change in
                       reinforcement frequency. (Study 7)

By way of summary the authors conclude that their
investigations have demonstrated that the proficiency is
affected by collective reinforcement, and that, at least
generally, the course of team learning parallels the
course of individual learning when subjected to similar
operant conditioning procedures, and that the attainment
of a team is predictable from a knowledge of team arrange-
ments and individual team member proficiencies.

Klaus and Glaser suggest several guidelines for the
training manager for training teams or for maintaining
existing levels of proficiency:

1.  team practice should result in clear and
    immediate reinforcement following each
    correct response; practice in the absence
    of team reinforcement for criterion level
    performance is more than likely to lead to
    a decrement in team proficiency.

2.  adding a redundant member to a team to
    work in parallel with an existing member
    at a particularly sensitive position can
    be expected to result in an eventual net
    decrement in team proficiency.

3.  team training is likely to proceed most
    efficiently when the individual members
    have thoroughly mastered their own specific
    assignments beforehand.

4.  experience with the conditions of team
    reinforcement seems to be critical for
    successful individual training of
    potential team members.  Matching rein-
    forcement schedules during individual
    and team training is desirable.

5.  the probability of a correct team response,
    as computed from knowledge of team struc-
    ture and the proficiencies of intended
    team members is quite likely to be a
    maximum rather than an expected value, that
    is, below predicted level.

Meister (1976) recently reviewed much of the literature
on team training as part of his broader efforts related to
team functions in man-machine systems.  As in the case of
other reviewers, Meister raises questions and identifies
research gaps concerning distinctive team elements, the
similarity of team training and individual training, the
sequence of training for individual and team training, whether
team training is effective in increasing system output, and
the relationship between variables that influence team per-
formance training and individual training.  Citing various
illustrative studies, Meister draws the following conclusions
regarding team training:

1.  team learning - on the surface team learning ex-
                    hibits the same performance curve
                    displayed by the individual oper-
                    ator (p.268)

2.   individual vs. team training  – individual training
                                      is superior to team
                                      training for simple or
                                      only moderately complex
                                      tasks.  Team training
                                      appears to be relatively
                                      ineffective in producing
                                      performance beyond that
                                      resulting from individ-
                                      ual operator training
                                      (p.270)

3.   fidelity of training          – high fidelity training
                                      conditions are important
                                      determiners of opera-
                                      tional task performance
                                      where fidelity refers
                                      to equipment, procedures,
                                      or skill requirements.
                                      Input fidelity is more
                                      crucial than output
                                      fidelity (p.271)

4.   feedback – knowledge          – given incompatible criteria
     of results                       of system performance such
                                      as speed and accuracy,
                                      teams will emphasize
                                      that aspect of performance
                                      about which they receive
                                      knowledge of results (KOR),

even though other aspects of system performance deteriorate as a consequence. If criteria are changed, team performance will be modified quickly to emphasize that aspect of performance which was previously neglected. Concurrently, team performance on the other aspects will deteriorate. However, if the team changes from a single criterion to several criteria, teams will continue to stress that aspect of performance about which they had previously received KOR (p.273)

5. task complexity - team training, like individual training, is affected by task complexity. Training is, of course, easier and performance superior on less complex tasks. Task organization in team training is a less significant variable than task complexity (p.276)

1.0

1.1

1.25   1.4   1.6

2.8   2.5
3.2   2.2
3.5
2.0

1.8
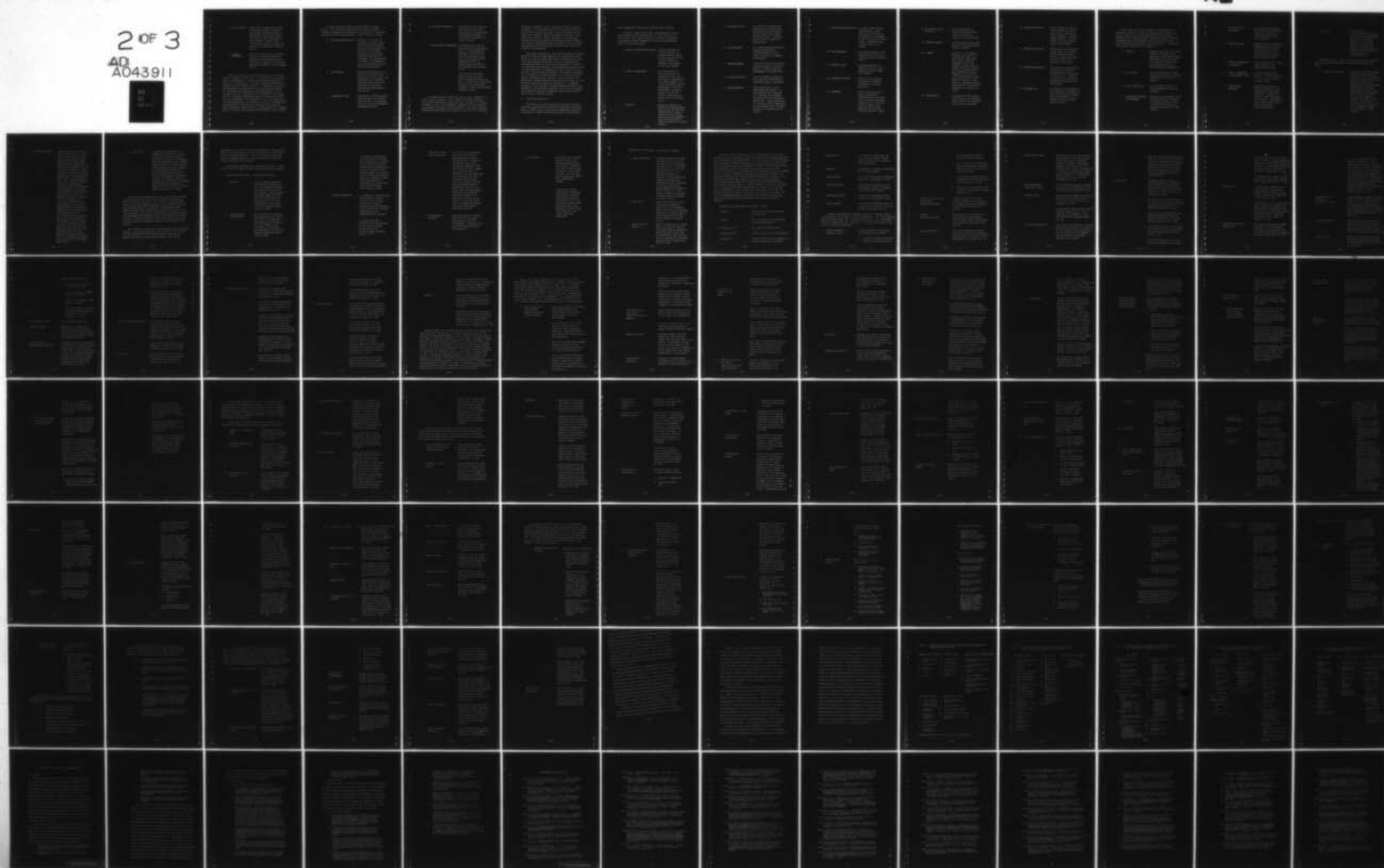
6. reinforcement  - individual reinforcement during
                    early team training overcomes
                    the characteristic decrement in
                    proficiency that occurs during
                    the transfer from individual to
                    team training.  However this
                    reinforcement does not reduce the
                    amount of team practice required
                    (p.276)

7. training       - during training, teams in highly
   flexibility      uncertain situations should be
                    provided with opportunities out-
                    side system operation to establish
                    operating procedures and principles
                    (p.277)


Some of the specific technical problems identified by
Meister include (1) difficulty in specifying what should be
taught in "teamwork," (2) team training effectiveness is
likely to be fortuitous if training cannot be controlled by
specifying what is being learned, (3) inadequate attention
to development and application of group learning curves,
(4) methodological problems of determining what a group
learning curve as a combination of individual curves means,
and (5) inadequate information about task characteristics
for both determinate and indeterminate tasks in relation to
training mechanisms.  In proposing a series of developmental
implications for the design of training of prospective
system operators, heavy reliance is placed upon the recommen-
dations of Briggs and Johnston (1967) (Meister 1976, p.288).

In their review of team training research, Wagner et al. (1975) included some additional recent research findings regarding team training and performance in emergent situations which deserve mention. These findings include:

1. prior motivational states - contrary to findings in laboratory studies, prior motivational states were found to be less important in field team studies; training in coordinative skills was important to compensate for deficiencies in member's performance or to overcome temporary situtional problems (p.18)

2. team awareness - existing technologies, e.g., split or multiple screen techniques of television, can effectively train members regarding their roles and the need for effective communication and interaction (p.23)

3. interpersonal skills - preliminary research results indicate that CAI training does not have a discernible effect on company commander's performance (p.24)

4.  low fidelity simulation     - available findings showing
                                   low transfer from team
                                   training to the operational
                                   environment centered on
                                   established situations not
                                   emergent (p.26)

5.  team structure & composition- increasing task load did
                                   not affect team performance
                                   when all the information
                                   necessary to perform the
                                   task was available to the
                                   team; teams showed better
                                   performance when all
                                   members were included in
                                   the communications network
                                   (p.30)

                                   team member replacement
                                   findings from research
                                   under established conditions
                                   (i.e., little effect generally)
                                   conflict with operational
                                   experience under high personnel
                                   turnover   (p.32)

In summarizing the results of their review, Wagner et al.
(1975, p.32) concluded:  "The research findings discussed
above which show that a particular team structure is "better,"
or that one type of reinforcement schedule is more effective
than another, are quite fragile results.  They can be largely
obviated by such things as a lack of fidelity in the training

situation (Campbell, 1971). The nature of the training
situation is a critical element to be concerned with for
future team training research. Up to now tasks used to
study team training, with some notable exceptions, have
been quite limited. Recent programs in the Army have
demonstrated the possibility of developing high fidelity,
yet low-cost simulations which may provide team training
researchers with the controls to study "team skills" in
realistic environments."

The above collation of team training research findings
points to potential opportunities for integrating infor-
mation but also provides additional evidence for the view
that team training technology is still underdeveloped.
Conceptualizations of team training contained in section
3.0 concerned with providing environmentally-oriented train-
ing opportunities for learning and skill acquisition have
not been researched and developed. The limited knowledge
base available is composed primarily of laboratory-based
theory, methodology and findings. There have been few
substantive contributions for dealing with problems of team
definition and team training requirements. A complete
strategy of team training oriented toward operational per-
formance as the principal dependent variable has not been
and probably could not be designed solely from available
team training research results.

4.3  Small Group Behavior

The question to which we now turn is what findings
from small group behavior research, including team perfor-
mance, related to the theoretical developments discussed
in section 3.2 might contribute to dealing successfully

with fundamental team issues including team training.

Meister's (1976, pp.285-287) comprehensive review of
team functions and team performance, using illustrative
case studies and a large number of references related to
man-machine systems resulted in a series of conclusions
which are presented below:

1.  group vs. individual performance - group performance is
                                        usually superior in
                                        problem-solving tasks,
                                        although groups may not
                                        be cost-effective
                                        because of the number
                                        of men they require

2.  small vs. large groups          - the superiority of
                                        group performance in
                                        problem-solving tasks is
                                        manifested  primarily in
                                        very small groups (i.e.,
                                        as one proceeds from the
                                        individual to the two
                                        man-group).  Groups of
                                        larger size are not
                                        usually significantly
                                        better than the two man-
                                        group

3.  monitors                        - adding an observer in
                                        monitoring improves detec-
                                        tion of the two minitors
                                        independently. Teams of
                                        monitors adopt various
                                        strategies for combining
                                        their performance, but
                                        these strategies are rarely
                                        optimal

4. organizational size – in industrial systems there appears to be a curvelinear relationship between organizational size, work output and work quality. Organizational size is related to absence rate

5. crew composition – crew composition significantly affects crew behavior, evidence relating to the effect on output is somewhat inconclusive

6. member replacement – little description on team performance results if only one member is involved and the replacement is of equal skill

7. performance variance – team performance variance is only partially determined by individual member performance

8. team organization – team organization in part determines team output. A hierarchical team structure is a favorable arrangement provided it is not strictly a serial one. Team performance in a serial task is determined by the weakest link, and overloading is a distinct possibility

9. indeterminate organizations - in highly indeterminate organizations, teams experience difficulties in organizing themselves to come to grips with their tasks. Information processing tasks are an example

10. team organization - the effectiveness of team organization varies as a function of task characteristics

11. division of labor - system performance is generally superior when tasks are divided among team members

12. procedural flexibility - except under emergency conditions, procedural flexibility is highly desirable

13. interaction - both in training and in actual performance independence (non-interaction) is highly desirable. Interaction at either the input or output level distracts the operator from task specific duties

14. independence/load       - both independence of
    balancing                 function and load balan-
                              cing are needed for
                              superior team performance

15. redundant personnel     - adding redundant personnel
                              may have both positive and
                              negative effects

16. feedback                - operators will attempt to
                              maximize the aspect of
                              performance about which
                              they receive specific
                              feedback, even at the
                              expense of other team per-
                              formance characteristics.
                              When changes are made in
                              feedback criteria, team
                              successfully adjust except
                              when the change is from
                              single to compound criteria
                              when team will continue to
                              emphasize the single cri-
                              terion

17. communications          - non-task-required communi-
                              cations during crew-perfor-
                              mance reduces the effective-
                              ness of the performance

18. communication channels  - visual methods of communi-
                              cating information within
                              the team are superior to
                              verbal channels.  Adding a
                              verbal channel to a visual
                              channel does not produce
                              superior performance

19. communication structure - differences in performance
                              result from differences in
                              communication structure,
                              the more direct the trans-
                              mission permitted by a
                              structure, the better

20. communications patterns - variations in communication
                              patterns are related to
                              performance but not in any
                              one-to-one way.  Training
                              in communications does not
                              significantly improve team
                              performance

21. motivation, etc.        - the amount of information on
                              the effects of motivation or
                              other attitudinal variables
                              on crew performance is too
                              sparse to permit drawing
                              any conclusions

Davis (1969, pp.77-87) reviewed a large amount of
available research in terms of individual performance in a
social context and the ways individuals combine their
behaviors into a group product.  He then reviewed available
knowledge about environmental and human qualities that
might influence performance at the group level.  The follow-
ing summary reflects Davis' findings:

1.  group size               -    changes in personal and inter-
                                  personal processes (e.g.,
                                  feelings of inhibition, group
                                  geography) that occur with
                                  an increase in group size
                                  have primarily negative
                                  implications for performance

2.  eye contact              -    invites interaction, occurs
                                  more between friends, implies
                                  credibility, difficult to
                                  measure

3.  group composition        -    is difficult to relate to
                                  task performance except at
                                  extremes

4.  intellective abilities   -    measures of individual ability
    and performance               are insufficient predictors
                                  of group performance, which
                                  is affected by interactive
                                  discussion and personal con-
                                  viction

5. personality traits of group members

   - present pregroup measurements have marginal status; they have seldom been validated against actual social behavior

6. group cohesiveness

   - develops from interpersonal attraction within a group and/or because goals are best achieved by group action and are in accord with individual goals

7. effects of cohesiveness on performance

   - can be distracting as interaction becomes more important than tasks

8. effects of performance on cohesiveness: a cycle

   - "Nothing succeeds like success." Group failure can also be a spur when due to external forces

9. cooperation and competition

   - cooperation behavior is found in groups which are rewarded as a whole when successful, competitive behavior where individuals are rewarded. Cooperative groups have higher performance records than competitive groups.

10. norms                    - are determined by
                               (1) behavioral expectation,
                               and (2) limits of tolerable
                               deviations about this
                               expectation.  Positive
                               (praise, approval) and
                               negative (expression of
                               displeasure) sanctions lead
                               to convergence to a
                               collective norm

Helmreich's et al. (1973) review of performance research
includes social facilitation, task performance and risky
shift.

1. social facilitation      - current view of the presence
                               of others, whether as co-
                               acting or observing increases
                               the general drive state and
                               thereby increases the
                               probability that the dominant
                               responses will be made,
                               assuming that a high drive
                               state inhibits the acquisi-
                               tion of new responses
                               (Zajonc 1965, 1966, 1970);
                               presence of others is a
                               learned source of drive and
                               not an innate biological
                               drive (Cottrell, 1968)
                               (p.344)

2.  task performance  -    major concern has been with
                           task, group size, and group
                           composition with less atten-
                           tion to group member inter-
        .                  action and the interaction
                           between group composition and
                           situational variables such as
                           task meaningfulness, and few
                           attempts to conceptualize and
                           operationalize a multivariate
                           approach or to study changes
                           over time.  Findings reported
                           by various investigators
                           include (1) group productivity
                           is a function of the inter-
                           action between member ability,
                           interpersonal relations,
                           position structure, and kind
                           of task, (2) contrary to
                           laboratory findings, group
                           effectiveness in research
                           organizations was correlated
                           negatively with occupational
                           and educational level,
                           heterogeneity and group size,
                           (3) groups of intermediate
                           heterogeneity displayed less
                           tendency to structure their
                           tasks and outperformed homo-
                           geneous groups, and (4) task
                           structures were the more
                           powerful (than task organiza-
                           tions) in influencing achieve-
                           ment, consistency, and match-
                           ing (p.345)

4-33

3.  risky shift    —  a variety of approaches, e.g.,
                       leadership, diffusion of respon-
                       sibility and familiarization,
                       have been followed; less cohesive,
                       more heterogeneous groups exhibit
                       greater risky shift than cohesive
                       and homogeneous groups; findings
                       on leader behavior and parsi-
                       monion provide weak support on
                       this relationship and controlled
                       research is lacking; risk is a
                       cultural value and when individuals
                       receive relevant information
                       about other's risk level, shift to
                       greater risk levels (p.346)

Davis (1973) reviewed theory and research involving the
actual interaction of two or more people in a cooperative,
mixed-motive, or competitive relationship in group problem
solving and group decision-making.  Davis (p.503) notes that
most research studies on cooperative group performance
emphasize either group composition (ability relative to the
task, personality variables, leadership), situational factors
(reinforcement contingencies, group organization), or group
process.  Further he points out that the "ideal study would
of course explicitly consider composition, situation, and
process."

With regard to cooperative interaction in group decision-
making, it was noted that the focus in America for the past
15 years has been on risk-taking whereas in Europe the
emphasis has been on "group polarization."  The latter

hypothesis is stated as "the average post-group response will tend to be more extreme in the same direction as the average of the pre-group responses."  Many of the design and data analysis problems plaguing group polarization studies much as they do choice shift studies.

The following findings were selected from Davis' report from a large set, some of which have already been described:

Cooperative Interaction:  Group Problem Solving

| | | |
|---|---|---|
| 1. ability | - | recent research indicates that group performance is a joint function of ability and group size relative to task demands, and that over-all group performance can often be predicted from a knowledge of the ability composition of the group apart from process consid-erations (p.503) |
| 2. reinforcement contingencies | - | more effective in altering participation rates when it was given to individuals and applied to individuals, but more change in the perception of the other group members resulted from feedback applying to the group (p.505) |

- in comparing performance
  and intragroup attraction
  under competitive, coopera-
  tive and individualistic
  reinforcement contingencies,
  arousal was higher, per-
  formance better, and attrac-
  tion to other group members
  lower for competitive than
  either cooperative or
  individualistic conditions,
  which did not differ
  significantly (p.506)

3. group organization    - in studying coordination and
                           collaboration, results
                           indicated higher group
                           productivity without
                           collaboration when coordina-
                           tion was required, and with
                           collaboration when
                           coordination not required

                           a suggestive study
                           indicated that interacting
                           groups are more likely
                           to intervene in an
                           emergency than co-acting
                           groups (p.506)

4.  individual versus  -  superiority of cooperative
    group performance      pairs over individuals
                           demonstrated is concept
                           attainment for a variety of
                           conceptual rules, task
                           difficulty conditions, and
                           interaction formats; compar-
                           able findings found on
                           importance of group decisions
                           for group decision from
                           research on risky shift;
                           such clear superiority has
                           not been demonstrated on
                           production tasks such as
                           those used on brainstorming;
                           mathematical aggregation
                           rules were superior to
                           behavioral concept for very
                           small or large likelihood
                           ratios in comparing individ-
                           uals and group process
                           conditions (p.506)

5.  interpersonal      -  through training to rely on
    learning               different cues to under-
                           stand others' criteria
                           in judgments, acquisition of
                           new skills and be facili-
                           tated (p.507)

6. motivation      - decrement in performance
has been found to be
roughly proportional to
the number of coordina-
tion links between pairs
of members; in Steiner's
analysis, the loss was
due to motivation rather
than coordination
(p.508)

- literature on group
productivity, drive and
cohesiveness indicates
that productivity and
cohesiveness tend to be
positively related under
high group drive and
negatively related under
low group drive and
normal operating
conditions

Cooperative Interaction:  Group Decision Making


1.  group composition  -    McGrath and Altman's (1966)
                            argument that the crux of
                            the composition-performance
                            relation in the patterning
                            of different amounts of an
                            attribute is yet to be
                            addressed seriously;
                            problems of measurement and
                            control and conceptual
                            inadequacies have continued
                            to prevent unambiguous
                            group composition studies of
                            choice shifts (see risky
                            shift) as they have studies
                            of other group performance
                            variables (p.510)

2.  group size         -    group size continues to be
                            a relatively unpopular
                            topic, as it is throughout
                            small group research, perhaps
                            because of a general lack of
                            theory which defines size
                            as an important parameter
                            (p.511)

3.  social process     -    popular explanation of choice
    factors                 shift stresses the role of
                            individual change preceeding
                            group decision rather than
                            the possibility that the pro-
                            cess of aggregating individual
                            preferences can produce the
                            shift (p.511)

4-39

Steiner's (1972) typology of tasks outlined below provides a structure for considering a variety of substantive findings relating to group process and productivity. It will be recalled that Steiner's objective was to examine empirical literature dealing with the processes and productivity of comparatively simple task-oriented groups with emphasis on the findings from laboratory investigations. Central to the theory he suggested are the concepts that task demands and participants' resources determine maximum productivity, i.e. potential productivity, and that process determines whether or not the product will be more than just the sum of the individual. Actual productivity equals the potential productivity minus the losses due to faulty process. Steiner (1972, p. 9) points out that from this perspective the question of the superiority of groups or of individuals is not a meaningful one because the answer is dependent upon the nature of the task, the fund of resources, and the ease and dependability with which individuals or groups can employ the process that transform resources into high quality products.

Steiner's partial typology of tasks includes:

unitary                      - one or more persons must each
                               do whole job

division                     - parts of task can be performed
                               by different members

maximizing task              - how much or how many only

optimizing task              - requires correct or best outcome

disjunctive                  - product of one or more members is
                               used as output for the group

conjunctive                    - all members perform task, but
                                 like a chain, weakest member
                                 decides outcome (vs. strongest
                                 for disjunctive)

additive                       - combination of outputs contributed
                                 by all group members

discretionary                  - group can weigh member performance
                                 arbitrarily according to skill

permitted process              - tasks differ regarding the way
                                 they permit members to combine
                                 their individual products

prescribed process             - process for achieving maximum
                                 success is prescribed by tasks

nominal group                  - considering individual output as
                                 if part of a group (e.g., if one
                                 member successful, all are)

A number of substantive findings contained in Steiner (1972)
are discussed below under the following headings: (1) group perform-
ance on unitary tasks, (2) effects of group size, (3) consequence
of group composition, (4) motivation, (5) payoffs and group type,
and (6) systems and process.

1. group performance          - limiting factors in achieving
   (unitary tasks)              full productivity include:

                               1. failure of status differences
                                  to parallel the quality of

the contributions offered
by participating members

2. the low level of confidence
   proficient members sometimes
   have in their own ability to
   perform the task

3. the social pressures that an
   incompetent majority may exert
   on a competent minority

4. difficulty in evaluating the
   quality of individual contribu-
   tions (p. 38)

intact vs ad hoc crew          - regular (intact) B-26 crews'
composition                      group performance was superior
(disjunctive task)               to ad hoc (participating members
                                 from different crews) crews
                                 (p. 25)

status                         - for crews with a history and a
(disjunctive task)               future, high status members
                                 significantly effect performance,
                                 both negatively and positively
                                 (p. 25)

conjunctive task               - not very extensively studied;
                                 nature of criterion can determine
                                 whether tasks are conjunctive or
                                 disjunctive or additive (p. 31)

| | |
|---|---|
| discretionary tasks | – the quality of the group product depends heavily upon the process the group employs; unweighted average of members' independent judgment was found to be very accurate when process is prescribed a variety of combinational rules may be employed; not appropriate when objective is to maximize performance (p. 37) |
| group performance (divisible tasks) | – organized groups found to perform many tasks more effectively than individuals working alone (p. 65) |
| dividing tasks | – social and environmental constraint sometimes dictate that only one of several possible divisions is acceptable (p. 65) |
| | – in real life, most divisible tasks probably require that a set of outcomes be assembled in a way that generates a complex product (p. 66) |
| division and matching | – when these are specified, a group's potential productivity is determine by the imposed role structure and by the resources of the members who are required to perform specific roles (p.66) |

- when left unspecified, the group
  will have to make organizational
  decisions concerning who shall do
  what when; group process herein
  includes both the behaviors by
  which organizational decisions
  are made and the implementing
  actions (p.66)

2. group size

- assuming random selection of
  group members and a disjunctive
  task, potential productivity
  will tend to increase a a decel-
  erating rate as group size is
  enlarged (p. 103)

- for conunctive tasks, increases
  in group size will cause potential
  productivity to decrease at a
  decelerating rate (p. 103)

- when the tasks are additive, the
  relationship between size and
  potential productivity will be
  positive and linear (p. 103)

- size should not affect the poten-
  tial productivity of groups that
  are performing descretionary
  task (p. 103)

- relationships between size and
  potential productivity are more

difficult to infer for divisible
tasks; however, such relationships
should be positive and curvilinear,
increases in size being responsible
for decelerating increases in
potential productivity (p. 103)

- as groups become larger, process
losses will ordinarily increase
at an accelerating rate (p. 103)

critical size

- critical size probably varies,
being smaller when the task
requires rapid, continuous and
complex communication than when
it does not (p. 101)

- although the data are very limited,
some findings are available for
dyads, triads, and larger sizes
in relation to actual productivity
for selected tasks and group
structures (e.g., polarized
groups) (p. 103)

3. consequences of group
   composition

- not a great deal is known about
the effects of dispositional
variables on group process, or
even about the impact of resources
on actual productivity (p. 105)

|  | - no very satisfactory body of theory of homogeneity - heterogeneity of groups; a theory of composition effects should be concerned with identification of variables on which homogeneity - heterogeneity really matters, and it should relate h - h on these variables to the consequences they are likely to promote (e.g., effects on potential productivity, process losses, or actual productivity) (p. 108) |
| heterogeneity of resources (disjunctive tasks) | - heterogeneity of members abilities tends to produce high potential productivity, manifested most in difficult tasks; heterogeneity is responsible for large process losses when dispositional qualities affect the weighting process (p. 111) |
| conjunctive tasks | - homogeneity is likely to be an advantage; process loss should not be greatly affected by h - h homogeneity less likely to generate dissatisfactions (pp. 111-112) |
| additive tasks | - heterogeneity has no effect on potential productivity but may be responsible for large process losses (p. 112) |

- process losses occur when

                                              1.  no provision is made for
                                                  proportional reward

                                              2.  when inequality of members
                                                  ability is apparent

                                              3.  little interpersonal coordi-
                                                  nation is needed

                                              4.  when total amount of payoff
                                                  is thought to be a direct
                                                  function of the total
                                                  resources (p. 115)

discretionary tasks          -  little research completed

divisible tasks              -  heterogeneity allows high
                                potential productivity but it
                                complicates the matching process
                                and it may have adverse effects
                                on motivation (p. 117)

heterogeneity of             -  although dispositional qualities
dispositional qualities         affect members' ratings of their
                                satisfaction with group expe-
                                riences and outcomes (see reviews
                                by Mann 1959 and Heslin 1964),
                                evidence concerning the impact
                                of such variables on actual
                                productivity is sparse and
                                contradictory (p. 127)

                                        - effect of dispositional hetero-
geneity on performance may be
expected to depend upon task
demands (p. 127)

                                        - when an adequate role system is
available to guide collective
action, dispositional qualities
may have little effect on outcome;
in the absence of a role system,
heterogeneity may either promote
or inhibit task motivation and
the solution of organizational
problems; evidence sparse and
inclusive (pp. 127 & 130)

group size and composition - large groups tend to be more
heterogeneous than small ones,
though individual members of the
former are typically less uniquely
different from their associates
than are their counterparts in
small groups (p. 130)

                                        - large groups tend to have more
dominance conflict which create
coordination problems (p. 129)

4.  motivation                       - Steiner emphasizes (1)  how the
motivation of an individual are
affected by the presence of
others, and (2)  how rewards

|                         |   | should be allocated to group members in order to minimize process losses (p. 131) |
|-------------------------|---|---|
| social facilitation     | - | effects of co-workers and spectators on individual performance easy to detect but difficult to explain (p. 132) |
|                         | - | some studies suggest that "mere pressure" is not sufficient to produce social facilitation or inhibition (p. 134) |
|                         | - | evaluative apprehension is likely to have a facilitating effect when task behaviors have been well learned and are expected to evolve favorable appraisals. Inhibitory effects may be expected when the opposite is true (p. 135) |
|                         | - | competetive attitudes may be responsible for faster but less accurate performance; or it may result in moderating ones behavior or seeking favorable responses (pp. 135-136) |
|                         | - | modeling one's behavior after others can have either a facilitating or inhibiting effect on |

performance depending whether the model performs in accordance with task demands (p. 136)

- the subtle effects above are likely to be overshadowed by the impact of the group's system for allocating payoffs (p. 137)

5. payoff systems

- in many cases the payoffs of one individual are linked to those of other members of the same group, and indirectly to the payoffs of persons in other competitive or cooperative groups (p. 160)

- game theory findings are inconsistent and appear to have limited applicability to most real-life situations (p. 160)

- internal (member to member) payoff relationships and external (group to group) interdependencies affect performance but the evidence is not yet adequate to justify categorical conclusions (p. 160)

- the mediating effects of tasks demands have not yet received much attention, however it is apparent that the prescribed process

|                  | depend on whether the task is additive, disjunctive, conjunctive, discretionary or complementary, and payoff systems should be matched to the task (p. 161) |
|------------------|---|
| cohesion         | - is a consequence of motivation and may be expected to vary as a function of the payoff system that guides the group actively (p. 164) |
|                  | - attraction to the group reflects members' appraisal of the payoffs they may receive, the subjective probability that the desired payoffs will actually be delivered, and the cost of membership (p. 164) |

Steiner (1972, pp. 165-182) provides a variety of evidence for the concept that the group is a system, and the process is the essential bond by which members are held together in relationships that impart a quality of wholeness to the group. He states "Without process, the whole would be nothing but the sum of its parts, and the group could be relegated to the realm of metaphor or illusion. However, the group is an active enterprise in which members reciprocally shape one another's actions. Collective process transforms an assortment of individuals into a sound system" (Steiner 1972, p. 165). Citing the stablizing effects of norms and roles, the importance of shared fate and functional interdependence, the lessons from leadership research, the orderliness of system process, the methodologies available for study of interaction analysis, Steiner presents a body of knowledge useful in developing improved approaches to the study of teams and team performance.

McGrath and Altman (1966) report findings on more than
sixty simple and complex substantive variables in their synthesis
of the small group behavior field at that time.  The authors
developed a number of generalizations which they categorized
under the following headings:  (1)  characteristics of group
members, (2)  characteristics of the group, (3)  interpersonal
relations in the group, (4)  leadership, (5)  task performance
of the group members, (6)  task performance of the group, and
(7)  the role of personality and social factors in performance.

1.  characteristics of          -  consistent, positive relation-
    group members                  ship exists between the
    (members abilities             capabilities and skills of
    and experiences)               group members and their
                                   performance.

                                -  relationship is clear using
                                   objective measures of ca-
                                   pabilities, but much more
                                   ambiguous using self-reports
                                   (by subject, his fears, or by
                                   his superiors).

                                -  abilities of individual members
                                   however measured are not
                                   necessarily useful predictors
                                   of group task performance.

                                -  very consistent and positive
                                   relationship exists between
                                   members' abilities and mani-
                                   festations of leadership per-
                                   formance, as judged by observers
                                   of superiors.

|  |  |
|---|---|
|  | - members are not good judges of one another's capabilities, except with respect to leadership potential |
|  | - very weak relationship exists between group members' perceptions of one another's skills and objective ratings of morale, cooperation, and various other indexes of interaction processes |
| personality and biographical characteristics of members | - these characteristics have not been studied very extensively in the small group literature |
|  | - for those studied, there do not seem to be any pervasive or general propositions that emerge |
| member attitudes | - favorable member attitudes toward the group task and toward the situation seem to be partly a consequence of high social or task status in the group, job autonomy, cooperative group conditions, and induced perceptions of task success. |
| authoritarian attitudes | - in general, authoritarian attitudes show very little relationship to most interaction |

behaviors and inconsistent
relationships with performance
on tasks of various types

positions of
members in the
group

- general proposition is that
group members who have high
social or task status are
likely to have power and use
it, and to react favorably to
the group

- status is not only related to
power, but also to the individual's
commitment to the group and his
motivation toward group achievement

- with respect to task performance,
there is very little relationship
between the task performance of
individual members and their
social or task position in the
group

- this type of relationship requires
more study as does the relation-
ship between the position of
members in the group and the
performance of the group as a
whole

2. characteristics of
the group
(group capabilities
and experience)

- the more training and experience
groups and members have the
better they perform as in-
dividuals and groups. The

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generalization holds for ad
hoc laboratory groups and
operational (e.g., military)
task groups

- however, knowledge of group
capabilities alone is not
sufficient to predict level of
group performance (p. 59)

- little research has been con-
cerned with the way group
properties (such as capabilities
and level of training) achieve
their impact on group performance.
Little attempt is made to study
how various imput variables
produce their ultimate effect,
in terms of intermediate processes
and events.

group size
- although the general proposition
that the smaller the group, the
more effective its performance
is often substantiated, the situa-
tion is very ambiguous

composition of groups
- there is very little research on
group composition, and what
little there is gives an unclear
picture of the role of composition

3.  interpersonal
    relations in
    the group

    -   the overall picture suggests the
        interpersonal attractions, inter-
        personal communication, and per-
        ception of task success may vary
        inter-dependently, so that a
        manipulation of any one of them
        will lead to correlated changes
        in the other two (p. 61)

    -   successful induction of greater
        interpersonal attraction produces
        greater communication and increased
        perceptions of group task success

    -   similarly, successful manipulation
        of perceptions of group success
        produces greater interpersonal
        attraction and communication

    -   finally, it is possible that
        increasing the amount of commu-
        nication among group members will
        lead to more favorable perceptions
        of other members and of the group's
        performance effectiveness,
        although the latter point is not
        established in the present body
        of research information

    -   in these terms, we can suggest
        that attraction, perceived task
        success, and communication con-
        stitute an interdependent system
        of variables

- we can suggest that certain other variables, e.g., cooperative conditions, job autonomy, and high member status, are associated with or are determinants of this system

4. leadership

- groups with effective leaders tended to be characterized by good work relations with other groups, care of equipment, orderliness, and a range of indexes of morale. Effective leaders tend to be characterized by a high frequency of problem proposing, information seeking, and ego-involvement, in addition to the actions used to define their leadership effectiveness. However, they were not distinguishable from nonleaders, or ineffective leaders, on a number of other behavioral indexes

- fairly clear picture of who will emerge as leader or be an effective leader - the member with highest status, skills and training

- far less clear picture of just what behaviors characterize an effective leader or distinguish leaders from nonleaders

- no data in the sample on the task
  effectiveness of groups that had
  such leaders, nor on what kind of
  effect, if any, the presence of
  a good leader had on task perform-
  ance of group members

5. task performance       - research supports some common-
   of group members         sense suppositions about the
   (role of member          impact of member-level properties
   characteristics)         on individual task performance
                            in groups:

   1. the higher a person's
      general ability or intelligence
      and the greater his task
      aptitude, the better is his
      performance in a group

   2. there is a positive relation-
      ship between job performance
      and actual job knowledge,
      training and experience

   3. the above contrast somewhat
      with the factors that influ-
      ence group performance

   - personal-social factors, such as
     member personalities, attitudes,
     and subjective perceptions, do
     not have consistently clear rela-
     tionships to individual perform-
     ance

|                          | - | member estimates of one another's performance capabilities do not relate very well to actual (objectively measured) performance |
| role of environ-mental factors | - | freedom, a sense of involvement, the requirement to act, and feedback all enhance member performance |
| 6. task performance of the group (role of member characteristics) | - | member intellectual and task-relevant abilities (e.g., mechanical aptitude) are not consistently good predictors of group performance; individual job experience is |
| | - | personality and attitudinal characteristics are not consistentl related to group performance, except that the absence of extreme personality characteristics enhance group functioning |
| | - | subjective perceptions of various types (e.g., personal skill estimates or estimates of the skills of others) are not always associated with good group performance |

role of group                    - experience as a group (working
characteristics                    together for a period of time)
                                   has a positive relationship with
                                   group performance, as does
                                   relatively small size of the
                                   group

                                 - favorable interpersonal relations
                                   in the group (e.g., high cohesion,
                                   high morale) show unclear effects,
                                   although the trend is for high
                                   morale and cohesion to be
                                   accompanied by better performance

role of                          - reward and punishment, rather
environmental                      than explanation and illustration
factors                            alone, tend to enhance performance

                                 - there are differential effects
                                   of types of feedback on group
                                   performance (e.g., structured
                                   critiques have a more enhancing
                                   effect than completely unstruc-
                                   ture ones)

                                 - several work conditions (such
                                   as efficient routing of necessary
                                   information or direct and rapid
                                   access to information) have a
                                   positive effect on group perform-
                                   ance

- clarity of role definition
  (e.g., jobs each person is to
  do and relationships between
  various jobs) also aids group
  performance

7. role of personality
   and social factors
   in performance

- results are equivocal regarding
  the effects of personal-social
  factors on individual and group
  performance; confused results
  may be due to methodological
  problems, e.g., measurement
  technology

- conceptually, the effects may be
  nonmonitonic for personal-social
  factors as contrasted with the
  monitonic effect of aptitude or
  experience. Also, the appropriate
  model of group productivity may
  be that these factors enhance
  group performance only within the
  limits set by abilities, training
  and experience

- gaps to be filled by research on
  performance effectiveness of
  individuals and groups include:

  1. need a better understanding
     of the sequential linkages
     that begin with inputs in the

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form of member, group and
task characteristics, that
become manifested in interme-
diate interactive processes,
and that culminate in a perform-
ance output

2.  too little attention has been
given to systematically
establishing the links in this
complex chain

3.  need exists for more sensitive
appreciation of the parameters
and properties of different
types of performance, espe-
cially dependent variables
of member and group task
performance effectiveness

Hare (1976) organized the contents of his review of problem-solving into three categories: (1) group process and structure, (2) interaction variables, and (3) performance characteristics. This section of the report will emphasize findings associated with performance characteristics complementing the previous discussion of Hare's conceptual scheme for interactional analysis.

Hare (1976, p. 329) summarizes the findings on the superiority of the group over the individual as follows:

1. manual vs. intellectual tasks — group superiority is usually greater on manual problems than on intellectual tasks

2. individual superiority conditions — the group loses its superiority in accuracy and efficiency if no division of labor is required, problems of control are too great, or the group develops a standard of productivity which is lower than that of a separate individual

3. standards of productivity — the group develops a standard of productivity which is lower than that of a separate individual; in terms of man-hours an individual is usually more productive

4.  accuracy of reporting        -   because of a tendency to
                                      converge on a norm, groups
                                      will report fewer but more
                                      accurate facts than indi-
                                      viduals.  However, some
                                      increase in accuracy can
                                      be obtained by eliminat-
                                      ing group discussion and
                                      simply pooling the judg-
                                      ments of one individual or
                                      of several individuals

5.  accuracy of judgment         -   as a by-product of group
                                      discussion, the individual
                                      tends to be more accurate
                                      in his own judgment after
                                      he has heard the judgments
                                      of others

6.  "risky shift"                -   under some conditions in-
                                      dividuals make conservative
                                      decisions when they are
                                      alone but shift to more
                                      risky decisions after taking
                                      part in group discussion.
                                      The "risky shift" phenomena
                                      is more likely to occur:
                                      (1)  when the group discus-
                                      sion provides relevant and
                                      persuasive arguments,
                                      (2)  when decision responsi-
                                      bility has been diffused
                                      over the group, (3) when

other group members approve
risk-taking, and (4) when
the experimenter seems to
desire a risky outcome.
The "risky shift" phenome-
non provides a well-docu-
mented example of the
differences between indi-
vidual and group problem
solving

In addition to the question of the superiority of the
group over the individual, Hare (1972) also reviewed the lit-
erature with regard to the variables associated with produc-
tive groups and with regard to group versus group relationships.
The results are summarized below:

1. general characteristics    —  most productive groups,
   of productive groups           like most productive in-
   (step-following)               dividuals, are those which
                                  can best carry out the
                                  steps in the problem-solv-
                                  ing process (p. 330)

   structure - high           —  groups which have a struc-
   morale                         ture suited to their func-
                                  tion and have high morale
                                  based on a large number of
                                  intergroup friendships will
                                  be motivated to try harder
                                  and be the most productive

attitudes                          -   motivation of the group
                                       is lowered if some mem-
                                       bers show an indifferent
                                       and neglectful attitude
                                       toward the task (p. 331)

group organization                 -   organized groups are more
                                       productive not only because
                                       they have better procedures
                                       for solving task and social-
                                       emotional problems but also
                                       because the positions of
                                       members in the group are
                                       relatively stable and less
                                       time need be spent in a
                                       status struggle

                                   -   self-perceptions of groups
                                       indicate that productive
                                       groups tend to be aware of
                                       characteristics which make
                                       them effective (Torrance
                                       1953a with airplane crews)

                                   -   groups initially low in
                                       productivity can be made
                                       more effective either by
                                       increasing the task skill
                                       through training, by in-
                                       creasing their motivation
                                       by paying more attention to
                                       them, or by providing other
                                       incentives (p. 331)

2.  Criteria for                      - productivity criteria for
    productivity                        laboratory and field evalua-
    (laboratory vs.                     tion may be different
    field)

    effective vs. non-               - in effective--non-effective
    effective crews                    combat crews, no differences
                                       were found in problem-solving
                                       scores, manner of team per-
                                       formance, or the members'
                                       perception of their group
                                       interaction, but the effec-
                                       tive crews were better in
                                       use of manpower, complete-
                                       ness of participation, co-
                                       ordination, control, and
                                       flexibility

                                     - successful crews des-
                                       cribe groups which were
                                       better organized and more
                                       friendly and had a greater
                                       toleration for intermember
                                       conflict (Torrance 1973a)
                                       (p. 331)

3.  satisfaction vs.                 - individuals join groups
    productivity                       for three general reasons:

                                       1.  prestige of membership

                                       2.  help group reach a
                                           goal

3. value the association with the group members (p. 332)

intermember relation-
ships

    - high productivity in the task area is not always associated with productive intermember relationships since the former may sometimes be gained only at the expense of the latter (p. 332)

competition vs.
cooperation

    - Many examples from competition vs. cooperation studies. Generally competitive groups are less efficient and less satisfying to members

authoritarian
leaders

    - groups led by authoritarian leaders show results similar to competitive groups since in these groups all members are in competition for status in the eyes of the leader. Productivity is higher and morale lower than for groups led by democratic leaders, although in some research no differences are reported in variations of the two styles. Productivity refers

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to quantity of the output,
since the quality may be
higher for cooperative
groups (p. 332)

self-oriented needs      -  groups in which most members
have high "self-oriented
needs" rather than work
toward group goal or the
solution of the groups'
problems, average member
satisfaction goes down
along with productivity
(Shaw, 1956b) (p. 332)

-  members of groups high in
self-oriented need-expres-
sion also tended to perceive
themselves as less unified,
were rated as having more
conflict by the observers,
and completed fewer agenda
items, although their meet-
ings lasted longer (p. 333)

interpersonal con-      -  in another similar study,
flict                      high consensus was achieved
in those groups in which
there was interpersonal con-
flict if the members avoided
some of the conflict by

postponing difficult prob-
lems, showing little inter-
est in the task, withdrawing
from interpersonal contact
(p. 333)

4.  members' personalities    -    task requirements are impor-
tant considerations in
selecting members on per-
sonality or social charac-
teristics

member characteristics    -    characteristics of members
of productive groups:

1.    high scores on intelli-
gence

2.    cognitive complexity,
or,

3.    problem-solving reflected
in higher levels of edu-
cation

patterns of inter-    -    patterns of interaction can
action    be influenced in newly formed
groups by persons of given
personality characteristics;
may slow the group's devel-
opment

leader's personalities — leaders are more effective when their personality closely approximates the group's ideal of a leader (Greer, 1955) (p. 334)

5. compatibility of affectional orientation — incompatibility among members on ability to handle feelings and emotions will decrease productivity and control (Reddy and Byrnes, 1972) (p. 334)

6. social characteristics — major variables have been so apparent that they have received little experimental substantiation (p. 340)

1. adults more efficient than children

2. single sex groups more efficient than mixed

3. men and women do better in their cultural roles

4. groups composed of friends more productive than strangers

5. duration of membership positively related to productivity

7.  cohesiveness

    - cohesive groups tend to work harder regardless of outside supervision (p. 340)

    - cohesive groups will be especially productive if motivated to do the task well, e.g., B-29 crews (p. 340)

8.  group size

    - principle of least group size (Thelan, 1949). Diminishing returns found in both physical and intellectual tasks when group includes excess number of people (p. 341)

9.  task (complicated vs. simple organization)

    - complicated group organization for a difficult task performed under stress less likely to be highly productive than if there is ample time for a simple task with a simple organization (p. 342)

    definition of the situation

    - the major effects of changes in task are found in the definition of the situation. If it is clear that work is the object, more group productivity is achieved if

|                                  |                                                                                                                              |
| -------------------------------- | ---------------------------------------------------------------------------------------------------------------------------- |
|                                  | individuals do not spend too much time on individual goals, and are isolated from outside distraction (p. 342)               |
| laboratory vs. field performance | - laboratory performance better than field because of less emotionality                                                      |
| effect of role definition        | - work is facilitated if there is a clear set of roles which are appropriate to the task and are enforced                    |
| coordination                     | - with a task which requires complex problem solving or actual production of material, coordination, usually in the form of leadership, is especially important |
|                                  | - unless members expected someone to be especially knowledgeable, they reacted negatively to the informed person (p. 342)   |
|                                  | - if the person has an obvious ability to find the right answer, the group will follow his lead                             |

10. Communication net-
work

      — regardless of the char-
acteristics of the indi-
vidual members, a number
of changes can be made in
the communication network
which will increase pro-
ductivity:

1.  feedback from receiver
    to sender of messages

2.  usually increased par-
    ticipation (discussion)
    is associated with in-
    creased member satis-
    faction

3.  if newcomers join a
    group, there is a
    tendency for short-run
    decline in performance
    while the group reorgan-
    izes itself (Trow, 1960)

4.  groups which have the
    fewest communication
    links between the point
    at which information is
    received and the point
    at which a decision is
    made should be the most
    efficient (Roby and
    Lanzetta, 1956)

5.  the mode of communica-
    tion will create dif-
    ferences in a group's

ability to communicate
which may disappear in
the long run (p. 344)

11. leadership

- studies of organizational
effectiveness typically
report that good leadership
is a primary criterion for
efficiency

- although there is a tendency
for groups led by autocratic
leaders to produce more but
of lower quality than groups
led by democratic leaders,
there is always high produc-
tivity where a skilled leader
is playing the leader role
(p. 344)

- when leadership functions
are shared rather than cen-
tered in one person, then
productivity is increased
if role differentiation has
taken place (p. 344)

12. majority rule vs.
consensus

- laboratory studies report
that groups produce deci-
sions of higher quality

with less emphasis on per-
sonal orientations than do
groups using a majority
rule (p. 345)

- when a group must select
  from among a number of
  alternatives of which only
  one is correct, majority
  rule will give more relia-
  ble decisions in that the
  decision will be correct
  more of the time (Smoke
  and Zajonc, 1962) (p. 345)

13. decision rules          - observations of groups
                              reaching decisions suggest
                              that group decision behavior
                              is a combination of an indi-
                              vidual decision process
                              plus a conflict-resolving
                              process when members do not
                              agree (p. 345)

- variations of decision rules
  include:

  1. "truth wins"

  2. majority rule

  3. consensus

- all groups tend to have im-
  plicit rules which govern

the decision-making
process (Dulong, 1972)
(p. 345)

- comparing the decision
  schemes of majority,
  plurality, equiproba-
  bility and the highest
  expected value, they
  found that the "equipro-
  bability" scheme gave the
  best fit with their data.
  In this scheme, each stra-
  tegy advocated by a member
  during a discussion has an
  equal probability of being
  selected (p. 345)

- another study suggests that
  members try to reach a deci-
  sion which is "fair" in
  that most persons in the
  group reach their own level
  of aspiration as a result of
  the decision

- another study found that
  the best fit with actual
  data is obtained with a
  very simple model which
  assumes that the group
  decision is most often the
  median of the individual
  decision (Hare, 1970)
  (p. 346)

| | | |
|---|---|---|
| 14. | training and feedback | - one of clearest findings in the small group literature is that group productivity will be improved if training is provided for members, no matter what the task (p. 354) |
| | feelings of inferiority | - persons who believe their skills are inferior to those of the others in the group are less likely to use the skills they have |
| | feedback and involvement | - when feedback is provided, group members tend to work harder, especially if they are evaluated by an expert and become more involved |
| | feedback by TV | - although subjects look to human observers for evaluation, feedback without comment from a TV camera can be equally effective |
| | individual vs. group feedback | - feedback provided on an individual basis has been found to be more effective than group feedback, probably because it can give the individual member a clearer idea of how to change his performance (p. 355) |

type of reinforcement      - the type of reinforce-
ment or feedback also
makes a difference.
Negative feedback can
be stressful (p. 355)

level of aspiration      - if group members fail to
meet their level of aspira-
tion, they may try harder
or they may not (p. 355)

failure levels      - moderate levels of failure
produced a greater effort
to organize the group than
did either low or high
failure levels (p. 355)

feedback preference      - members of groups prefer
positive feedback and are
more willing to believe it
(p. 355)

success belief      - members who believe they
are successful, even though
they may not be, will try
to exert more influence
(p. 355)

As previously noted in section 3.2, Zander (1971, pp.171-203) summarized the research on group motives first in terms of six topical headings with four kinds of results under each heading, and secondly in terms of the variables involved and the events which follow from the presence of each.  The latter organization of information was provided to assist those interested in applied problems, and a summary in this format follows:

    1.   feedback on performance  - when feedback is available:
        of group

                                1. quality of the group's productivity improves for simple and complex tasks (those requiring considerable interaction)

                                2. improvement in quality increases as the completeness of the feedback increases, i.e., feedback on the score of the group as a whole and on each individual member is more effective than either of these

                                3. performance of individuals who have a stronger need to achieve success is more enhanced by fuller feedback

4. members make a more
accurate evaluation of
their group's perfor-
mance because the
information allows them
to establish a more
appropriate criterion
for appraising events
in the group

2. influence on group    -    if an observer has
from external                 information about the
sources                       group's performance,
                              he is likely to prefer
                              the same aspiration
                              for the group as the
                              members do

                         -    the level of performance
                              an external agent
                              suggests (intentionally
                              and otherwise) does not
                              have as much influence
                              on a group's aspiration
                              as does the suitability
                              of the suggestion in the
                              light of member's
                              experience; social
                              pressures from outside
                              are apparently more
                              influential if they
                              emphasize the repulsive-
                              ness of failure than if
                              they stress the attrac-
                              tiveness of success

- members will support one
  another in avoiding or
  derogating a task from
  an external source that
  is too difficult for
  them, provided they can
  do this without fear of
  repulsion from that
  source

- arousing an awareness of
  the undesirability of
  failure creates con-
  forming behavior, but
  simultaneously induces
  a tendency to avoid the
  task and to use private
  criteria in judging the
  group's success

3. difficulty of task   - a harder (challenging)
  group task is more
  attractive than an
  easier one, and certain
  events occur

  1. participants are more
     interested in what they
     are doing

  2. they produce more

  3. they have more favorable
     feelings

  4. they evaluate the
     group's performance
     better

- an easier task is less
attractive than a harder
one

1. members are less
enthusastic about the
work to be done

2. produce less

3. are more derogatory
toward the group

4. evaluate the group's
performance less
favorably

4. success versus
failure

- after repeated successes
group members:

1. perceive that future
promises a greater likeli-
hood of sources at that
level of difficulty

2. raise their anticipated
level of aspiration

3. develop feelings of
success and pride in the
group

4. assign a favorable evalu-
ation to their group's
performance

5. attribute greater value
to future success

6. develop a disposition to
seek future success

7. perceive their group to
be an attractive one

8. become committed to the
process of setting goals

- after repeated failure:

1. members are less inclined to be concerned about the probabilities of future failure, or success

2. instead, they seek means that will help them to avoid the unfavorable consequences of failure

- they tend to:

1. lower the group's goal or stick with one they have failed to reach

2. give an unapproving evaluation to their group's performance

3. see the activity as less important

4. believe the success on the task is less desirable

5. are less attracted to their own group

6. would like to judge the group in relation to its past perfor- mance than its goal attainment - they would gladly abandon altogether the practice of setting aspiration levels

5.  desire for achievement — a number of <u>conditions</u>
    of group success          arouse a desire that one's
                              group attain the pleasing
                              side effects of success:

    1.  the group sets an
        aspiration level
        for a series of trials

    2.  the group is successful

    3.  the member perceives
        he has a responsi-
        bility for or a
        commitment to the group

    - if and when members develop
      a stronger desire for
      achievement of group success,
      a number of events regularly
      occur:

    1.  members are cautious in
        setting aspiration
        levels

    2.  members perform better

    3.  have more favorable
        attitudes toward the
        group and its task

4. perceive that the product
   of the group depends upon
   their own effort

5. set their personal goals
   in accord with those pro-
   posed for them by
   colleagues

6. evaluate their personal
   performance in accord with
   the score obtained by the
   group

7. and support one another in
   the belief that achievement
   of success is important

Members also develop a desire to avoid
unfavorable consequences that follow
a failing performance by their group.

When the desire to avoid has been
induced in members, they tend to favor
unreasonably difficult goals and to
act in ways earlier described for
persons whose group has failed.

6. individual motives -  the challenge of working in
   for achievement       a group arouses desire for
                         personal success or avoid-
                         ance of failure

                      1. when feedback is group
                         performance-oriented,
                         personal motive causes
                         most direct concern with
                         selecting a challenging
                         but not too difficult
                         task

                      2. when feedback includes
                         his own output, as well
                         as the group, he is more
                         concerned with his
                         compative position and
                         is primarily interested
                         in the achievement of
                         individual excellence.
                         If the choice is avail-
                         able, he will prefer to
                         work for himself rather
                         than the group

                      3. those members who seek
                         to avoid the by-products
                         of failure try to be
                         helpful and work hard
                         when it becomes evident
                         it is necessary. When
                         placed in a central po-
                         sition, they tend to act
                         like a person with a
                         motivation to succeed

7.  competence of member  -  a member who has objective
                              evidence that he is more
                              competent than the others,
                              develops a greater interest
                              in the fate of the group and
                              works harder for its success
                              than does a less competent
                              member

8.  centrality of           -  one in a central position:
    position

                              1.  is aware of his greater
                                  responsibility for the
                                  outcome of the group

                              2.  has a stronger desire for
                                  the group to be successful

                              3.  prefers moderately challeng-
                                  ing goals for the unit

                              4.  develops greater tension
                                  when working for the group

                              5.  works harder

                              6.  produces more

                              7.  evaluates his own output
                                  in accord with the quality
                                  of the group's performance

                           -  central position person's
                              reactions are stronger if his
                              role is important in the flow
                              of work than if he has the
                              power to determine the group's
                              aspiration level

9. sources of better  -  better proformance occurs
   group performance       if a number of things
                           happen:

                                                1. members are aroused to
   have a strong desire for
   group success

     2. each new goal is placed
   moderately higher than
   the past level of
   successful performance

     3. members are made aware
   that the group needs
   each person's best effort

     4. feedback is provided on
   the score of the group
   as well as the scores
   of individual members

The effect of this successful performance gives rise
according to Zander to several useful properties in a group.
These include:

1. awareness of accomplishment.

2. feelings of satisfaction.

3. stronger desire for success.

4. groups work harder.

5. coordinate their efforts more effectively.

6. less strain on interpersonal relations.

7. more attracted to membership.

8. group becomes more productive.

Bowen and Siegel (1973) investigated several of
Zander's findings using M.B.A. students organized into
four-person and two-person groups reviewing papers by
each group.  The following results were obtained:

1.    confirmed the finding that perceived group
      effectiveness occurs over time.

2.    confirmed that own role satisfaction and
      own part in group satisfaction increase over
      time.

3.    confirmed that motivation increased over
      time.

4.    found that group attractiveness increased
      over time whereas Zander found no difference.

5.    found positive correlation between perceived
      group performance and personal involvement
      as simultaneous action whereas found that
      hypothetical performance leads to later
      involvement.

6.    found that group attractiveness correlated
      with perceived group performance; Zander
      found no significance.

As previously noted in this report (pp. 3-39/3-44), Hackman and Morris (1975, p. 46) take the position that the key to understanding the group effectiveness problem is to be found in the ongoing interaction process which takes place among group members while they are performing a task. Accordingly the findings abstracted from Hackman and Morris discussed below emphasize input-process-performance relationships:

1. patterns of interaction — interactions can result in "assembly effect bonuses," i.e., patterns of interactions developed to produce better outcomes, (Collins and Guetzkow 1964) (p. 48)

2. interpersonal training activities — interpersonal training activities can powerfully affect both the nature of the interaction process in groups and the quality of members' personal experiences. But the few studies that have tested the effects of such changes on actual task performance have yielded ambiguous or negative results (see reviews by Harold 1974, Kaplan 1973) (p. 48)

3. input-process relationships — factors shown to affect group interaction include:

|                              |     | 1. leader attitudes |
| --- | --- | --- |
|                              |     | 2. member personality characteristics |
|                              |     | 3. group size |
|                              |     | 4. group structure |
|                              |     | 5. group history or experience (p. 51) |

task-process
relationships

- almost every study that addressed the question unearthed substantial task-process relationships (p. 51)

4. process-performance
relationships

- little research conducted relating measured characteristics of group process to performance outcomes (p. 51)

valence model

- inferential support available for the valence model of process-output relationships (p. 52)

measures of group
interaction

- measures of group interaction predict task success better than did measures of members' task-relevant knowledge or various task training procedures (p. 52)

5.  input-process-performance - substantial variation in
    relationships (group    group performance on intel-
    process)                lective tasks is controlled
                            by the nature of the group
                            interaction process (p. 54)

    substance of i-p-p      - little is known about the
    relationships             substance of the input-process-
                              performance relationships
                              (p. 56)

    cultural norms          - typically the norms that
                              guide individual behavior in
                              groups tend to be rather "con-
                              servative," that is they mini-
                              mize the chances that members
                              will have to deal with un-
                              comfortable or anxiety-
                              arousing behavior within the
                              group (p. 60)

    social interaction      - can significantly affect how
                              much effort member chooses to
                              expend on a group task, and
                              that the level of effort can
                              easily change over time as
                              the characteristics of the
                              group interaction change
                              (p. 64)

    task performance        - at least in some cases group
    strategies                members are both capable and
                              desirous of implementing

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implicity-agreed upon per-
formance strategies without
explicit discussion of what
they are doing (p. 66)

-   there appears to be a per-
    vasive norm in groups not
    to address the matter of
    reformulating strategies
    explicitly (p. 67). Over-
    riding these norms may be
    a useful way to improve
    group performance effective-
    ness (p. 68)

group talent
enhancing

-   some evidence, e.g., from
    "training group" studies,
    suggests that group inter-
    action can result in new
    knowledge and skill which
    did not previously exist
    within the group (p. 71)

stantive variables included in Section 4.0 of this report.
In some instances, the findings are presented with topical
headings used by the author, e.g., Zander. Similarly, e.g.,
McGrath and Altman (1966) who reported 59 simple and 6 com-
plex substantive variables, the findings selected are in-
cluded within categories these authors chose for developing
operationally useful generalizations. In a very few instances,
some duplication of information contained in discussions of
theoretical and methodological developments earlier in the
report will be noted.

Consideration was given in planning the research to em-
ploying methodology referred to as conceptual variable analy-
sis, middle range theory building, or, what is now called,
propositional inventory development. This could not be
accomplished in those terms but the findings as collated can
be further analyzed and propositions developed. In addition,
the findings were collected within a theory-methodology-
findings framework, and interpretations and conclusions
within that total framework are the subject of interest, par-
ticularly with regard to the identification of opportunities
for application to team training and performance improvement.

In this context, several examples of concepts which
emanate from this collation of findings are: (1) enhancing
group performance depends heavily upon the adequacy with which

Tables 3 and 4 contain a summary listing of the substantive variables included in Section 4.0 of this report. In some instances, the findings are presented with topical headings used by the author, e.g., Zander. Similarly, e.g., McGrath and Altman (1966) who reported 59 simple and 6 complex substantive variables, the findings selected are included within categories these authors chose for developing operationally useful generalizations. In a very few instances, some duplication of information contained in discussions of theoretical and methodological developments earlier in the report will be noted.

Consideration was given in planning the research to employing methodology referred to as conceptual variable analysis, middle range theory building, or, what is now called, propositional inventory development. This could not be accomplished in those terms but the findings as collated can be further analyzed and propositions developed. In addition, the findings were collected within a theory-methodology-findings framework, and interpretations and conclusions within that total framework are the subject of interest, particularly with regard to the identification of opportunities for application to team training and performance improvement.

In this context, several examples of concepts which emanate from this collation of findings are: (1) enhancing group performance depends heavily upon the adequacy with which

group interaction is understood, measured and trained for, (2) team tasks in military environments vary along several technical and social dimensions and team training needs to be responsive to these task requirements in terms which are appropriate to whatever task-contingent combinations exist in real-world situations, (3) team training and team performance strategies need to include consideration of a large number of input-process-performance variables and relationships, (4) consideration must be given to distinctions between individual and group goals, how the latter are set, how alternative goals are selected by groups, and how compatibility-incompatibility between individual and group goals is dealt with, (5) a hedonistic philosophy associated with individual performance appears to be replaced or augmented by altruistic commitment to the group, (6) integration processes for combining individual members' contributions to team performance have been identified, and (7) strategies for developing team performance and performance criteria need to recognize that developmental processes are operating both for the individual and the team and continuous attention to the dynamics of the totality of the situation is necessary to understand, achieve and maintain desired levels of team performance.

TABLE 3 - <u>SUMMARY LISTING OF SUBSTANTIVE VARIABLES (TRAINING)</u>*
          <u>INCLUDED IN SECTION 4.0</u>

<u>Chapman et al. (1959)</u>     <u>Glanger (1962)</u>     <u>Klaus & Glaster (1968, 1970)</u>

1. organizational     1. interactions     1. reinforcement of team
   goal                                      responses
                      2. centralization
2. team skills                             2. team acquisition and
                      3. overloading          extinction
3. feedback
                      4. coordination       3. decrements in parallel
4. load                                        teams
                      5. extra-team
5. stress                input             4. team arrangement

                                           5. team composition and
                                              membership

                                           6. supplementary rein-
                                              forcement

                                           7. team environment simu-
                                              lation


   <u>Meister (1976)</u>          <u>Wagner et al (1975)</u>

1. team learning      1. prior motivational
                         states
2. individual vs.
   team learning      2. team awareness

3. fidelity of        3. interpersonal skills
   training
                      4. low fidelity simulation
4. feedback-
   knowledge of       5. team structure and com-
   results               position

5. task complexity

6. reinforcement

7. training
   flexibility

*See also Table 2, p. 4-3 (Briggs & Johnston 1967)

TABLE 4 - SUMMARY LISTING OF SUBSTANTIVE VARIABLES (SMALL
GROUP BEHAVIOR) INCLUDED IN SECTION 4.0

### Meister (1976)

1. group vs. individual performance
2. small vs. large groups
3. monitors
4. organizational size
5. crew composition
6. member replacement
7. performance variance
8. team organization
9. indeterminate organizations
10. team organization
11. division of labor
12. procedural flexibility
13. interaction
14. independence/load balancing
15. redundant personnel
16. feedback
17. communications
18. communication channel
19. communication structure
20. communications pattern
21. motivation

### Davis (1969)

1. group size
2. eye contact
3. group composition
4. intellective abilities and performance
5. personality traits of group members
6. group cohesiveness
7. effects of cohesiveness on performance
8. effects of performance on cohesiveness
9. cooperation and competition
10. norms

### Helmreich et al (1973)

1. social facilitation
2. task performance
3. risky shift

TABLE 4a- SUMMARY LISTING OF SUBSTANTIVE VARIABLES (SMALL GROUP BEHAVIOR) INCLUDED IN SECTION 4.0

### Hare (1976)

Superiority of the Group:

1. manual vs. intellectual tasks

2. individual superiority conditions

3. standards of productivity

4. accuracy of reporting

5. accuracy of judgment

6. "risky shift"

Group vs. Group:

1. general characteristics of productive groups

    step following
    structure - morale
    attitudes
    group organization

2. criteria for productivity

    laboratory vs. field
    crew effectiveness

3. satisfaction vs. productivity

    intermember relationships
    competition vs. cooperation
    authoritarian leaders
    self-oriented needs
    interpersonal conflict

4. members personalities

    members' characteristics
    patterns of interaction
    leaders personalities

5. compatibility of affectional orientation

6. social characteristics

7. cohesiveness

8. group size

9. task

    complicated-simple organization
    definition of situations
    laboratory vs. field performance
    role definition
    coordination

10. work communication network

11. leadership

12. majority rule vs. consensus

13. decision rules

14. training and feedback

    feelings of inferiority

    feedback and involvement

    feedback by TV

    individual vs. group feedback

    type of reinforcement

    level of aspiration

    failure levels

    feedback preference

    success belief

TABLE 4b - SUMMARY LISTING OF SUBSTANTIVE VARIABLES (SMALL GROUP BEHAVIOR) INCLUDED IN SECTION 4.0

### Davis (1973)

Cooperative inter-action - Group Problem Solving:

1. ability

2. reinforcement contingencies

3. group organiza-tion

4. individual vs. group perfor-mance

5. interpersonal learning

6. motivational

Cooperative inter-action - Group Decision Making:

1. group composi-tion

2. group size

3. social process factors

### Steiner (1972)

1. group performance:

   unitary tasks
   divisible tasks

2. group size

3. consequences of group composition

   heterogeneity of resources

   heterogeneity of disposition qualities

4. motivation

5. payoff systems

### McGrath & Altman (1966)

1. characteristics of group members

   abilities
   experiences

   personality

   biographical

   member attitudes

   authoritarian attitudes

   member position

2. characteristics of the group

   capabilities
   experiences
   size
   composition

3. interpersonal relations

4. leadership

5. task performance of group members

   member characteris-tics role
   environmental factors role

6. task performance of the group

   member characteristics role
   group characteristics role
   environmental factors

7. personality and social factors

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TABLE 4c – SUMMARY LISTING OF SUBSTANTIVE VARIABLES (SMALL
GROUP BEHAVIOR) INCLUDED IN SECTION 4.0

| Zander (1971) | Bowen & Siegel (1973) | Hackman & Morris (1975) |
|---|---|---|
| 1. feedback on performance of group | 1. perceived group effectiveness | 1. patterns of inter-action |
| 2. influence on group from ex-ternal sources | 2. own role and group satisfac-tion | 2. interpersonal train-ing activities |
| 3. difficulty of task | 3. motivation | 3. input-process relationships |
| 4. success vs. failure | 4. group attrac-tiveness | 4. process-perfor-mance relation-ships |
| 5. desire for achievement of success | 5. perceived group per-formance | valence model |
| 6. individual motives and achievement | 6. group attrac-tiveness and perceived group performance | measures of group |
| 7. competence of member | | interaction |
| 8. centrality of position | | 5. input-process – performance relationships |
| 9. sources of better group performance | | group process |
| | | L-p-p relation ships |
| | | cultural norms |
| | | social interaction |
| | | task performance strategies |

## 5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Summary

The purpose of this research was to review selectively the literature on small group behavior to identify scientific and technical advances potentially applicable to the development of an improved team training technology. Specific objectives included conducting a state-of-the-art assessment in both areas in terms of theories, methods and techniques, and findings on substantive variables; identifying specific small group behavior research contributions potentially useful in developing a strategy for establishing team, team training and team performance requirements; and preparing research program recommendations for capitalizing on small group behavior research advances supportive of team training technology needs.

The review of the team training research and operational literature was comprehensive, and the results indicate not only that team training technology is underdeveloped but also that few advances have been made during the past ten years because of limited research and development funding. Specific deficiencies include but are not limited to:

1. the absence of a theory of teams as units including a set of defining variables and supporting empirical data bases

2. population data on teams and related sampling designs

3.  analytical techniques and criteria for the
    study of teams, team training and team per-
    formance

4.  assessment, evaluation and feedback systems
    for use by operational units and team train-
    ing organizations

5.  an Instructional System Development model de-
    signed to meet team training requirements

6.  a narrow data base of substantive findings on
    Navy warfare or platform level training
    requirements

7.  absence of team training guidelines for use in
    the design of large, complex team training
    devices

The selective review and analysis of the small group

behavior literature emphasized substantive areas which might

contribute new concepts for the team, analytical techniques

for studying teams as dynamic units in which interactions

and situational factors are important elements, and methods

and techniques for the measurement and enhancement of team

performance within an input-process-output paradigm.  Par-

ticular attention was given to research related to theories

of groups, experiential learning, group motives and goals,

group performance and productivity, group growth and develop-

ment, and group interaction analysis.  The general trends

noted in the literature were:  (1) the increasing volume of

research publications, (2) progress in but concerns about the

quality of research and the failure to integrate theoretical

and empirical research, and (3) the continuing emphasis on

such research topics as conformity, interpersonal choice,

social perception, interaction process and leadership with little attention to roles, personality, social characteristics, group size and group productivity.

5.2 Conclusions

Major conclusions from this research are:

1.  as a result of limited support for theoretical and empirical research in team training and performance, numerous gaps exist at both the scientific and technology levels

2.  little progress toward the goal of developing a comprehensive technology relating to teams, team training and team performance can be expected under presently planned research and development programs related to teams

3.  Navy operational and training commands have documented their needs for improvements in team training and performance particularly with regard to issues such as the need for operational definitions of a team, the development of new educational technology, deficiencies in analytical techniques and criteria for determining team training requirements and measuring team training effectiveness and performance, and the need for new guidelines for use in the design of training systems and devices

4.  utilization of theoretical and methodological developments and findings on a large number of substantive variables from small group behavior research would facilitate the development of an improved technology of team training and team performance

5.  development of an Instructional System Development (ISD) model assigned specifically for team requirements is possible and would significantly enhance team training efficiency and effectiveness

6.  new programs of team research and development will need to employ strategies, e.g., the use of technical advisory groups, for maximizing

5-3

the use of the limited amount of expertise
presently available while developing a larger
national capability interested and competent
in team/group research

## 5.3 Recommendations

The review of the literature revealed areas of concerns
which involve Navy operational requirements for improvements
in team training, RDT&E policy relating to priorities and
funding for team training technology development, and scien-
tific and technical requirements.  The recommendations which
follow assume that the operational requirements are valid,
and that RDT&E policies of support will be consistent with
the importance and criticality of these requirements.

It is recommended that:

1. identified scientific and technical advances
   from small group behavior research be utilized
   in planning and implementing team training
   research and development programs as timely
   opportunities for making significant improve-
   ments in team training technology

2. research and development strategies recognize
   the importance of both laboratory and field
   settings as essential and complementary in
   developing and utilizing team training tech-
   nology

3. concepts of growth and development of teams as
   units in addition to growth and development of
   individuals, together with interaction analysis
   methods, team task typologies, and an input-
   process-output paradigm become essential tech-
   nical elements of team training research method-
   ology

4. team training and team performance be recognized
   as highly complex areas requiring support from a
   number of disciplines, and that multi-disciplinary
   capabilities be brought to bear in planning and
   implementing supporting research and development

5.  mechanisms be established for exchanging
    scientific and technical information re-
    lating to team and team research and
    development problems and opportunities on
    a continuing basis

6.  additional research efforts be supported to
    investigate other small group behavior re-
    search developments beyond those included in
    this research for possible application to team
    training needs

7.  further analysis be conducted on the large
    number of findings on substantive variables
    contained in this report with a view toward
    developing an inventory of propositions to
    fill gaps in team training technology bases

8.  an Instructional System Development (ISD)
    model for team training requirements in vari-
    ous warfare areas be developed beginning with
    surface warfare and support systems

9.  a prototype model of team growth and develop-
    ment be developed incorporating concepts and
    strategies associated with relevant research
    on small group behavior, particularly group
    interaction analysis, group productivity, and
    group motives and goals

10. a broad-based program of team performance
    research be initiated centered in the laboratory
    setting to provide fundamental, mission-oriented
    concepts, principles and data which must be
    available before progress can be made in develop-
    ing a team performance technology

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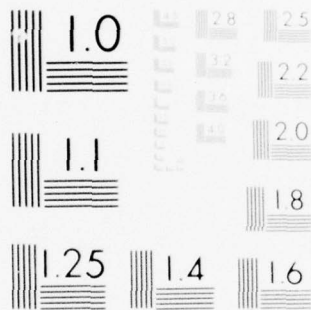
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The authors utilize the characteristics of computerized
command control systems to derive common training objectives
and to delineate several system training problems.  Theoretical
approaches and models of team training are discussed, e.g.,
organismic and stimulus-response.  Previous research on team
training is organized in terms of task environment, knowledge
of results and exercising variables.  A team training research
program is outlined oriented toward "a most important and
neglected research problem...how teams learn to respond
effectively in unusual, undeterminate, or high load situations."


Alexander, L. T., Kepner, C. H. and Tregoe, B. B.  The
    effectiveness of knowledge of results in a military system-
    training program.  Journal of Applied Psychology, 1962,
    46, 202-211.


An experiment to investigate the effects of knowledge of results
(KR) on performance improvement of a man-machine, information-
processing system.  Four 13-man crews were given a pretest
exercise, then 12 training exercises, then a posttest exercise
in air defense operations using their own operational equipment
and a simulated air environment.  Two experimental crews
received KR at a postexercise debriefing; two control crews
received no KR or debriefing.  The experimental crews improved
more than the control crews in all but one (tactical action)
function but improvement across functions was not equivalent.

Altman, Irwin and Terauds, Anita. Major variables of the small group field. AFOSR-TN 60-1207 (ASTIA AD NO. 250 740). Arlington, Virginia: Human Sciences Research Inc., November 1960.

This report reviews major and minor variables of the small group field. The review includes descriptions of variable subclasses, information about rates of appearance, and results of each variable's association with other variables. A special review of individual and group performance effectiveness variables is presented.

Bales, R. F. Interaction process analysis: A method for the study of small groups. Reading, Mass.: Addison-Wesley Press, 1950

A comprehensive report on the development of a category system for interaction observation. Exploratory hypotheses about the characteristics of interaction are presented, as well as preliminary data on cumulative norms for the observation system. The theoretical nature of social interaction is considered in terms of the objectives of small group experimentation.

Bennis, W. G. and Shepard, H. A. A theory of group development. In Gibbard, G. S. et al. (Eds.). Analysis of Groups. San Francisco, California: Jossey-Bass Publishers, 1974, 127-153.

The authors present a theory of group development based for the most part on observations made over a five-year period of teaching graduate students "group dynamics." The theory is applicable to groups that have as their goal improvement of their internal communications system. The core of the theory is that the principal obstacles to development are to be found in the orientations toward authority and intimacy that members bring to the group. Development involves movement from preoccupation with authority relations to preoccupation with personal relations. A two phase, each with three subphases, process is described.

Berkowitz, L. and Levy, B.  Pride in group performance and
    group-task motivation.  Journal of Abnormal Soc.
    Psychology, 1956, 53, 300-306.

These authors investigated the relationship between KOR and
motivation toward the group task using a simulated air defense
task, favorable/unfavorable feedback, and individual/team
performance KOR.  When teams received favorable evaluations,
their motivation toward the task increased, as measured by a
greater amount of task-oriented discussion during work period
breaks.  Highest motivation was associated with group rather
than individual KOR.  The authors concluded that team members
are interdependent in attaining reward and this produces high
motivation.

Birkett, B., Zagorski, H., Grace, G. and Murphy, B.  NORM
    briefing guide.  TM-(L)-3212-000-01.  Santa Monica,
    California: System Development Corporation, 5 January
    1968.

This package of materials was prepared for briefing military
personnel regarding the NORM computer program which was
designed to provide an automatic evaluation of a Sage crew
during an automated system training mission (ASTM).  The
package contains textual material and a set of slides.

Boguslaw, Robert and Porter, Elias H.  Team functions and
    training.  In Gagné, Robert M. (Ed.).  Psychological
    principles in system development.  New York: Holt,
    Rinehart and Winston, 1962, 387-416.

Reviews the concept and meaning of teams and team training,
major programs of team training research and technologies,
design of training systems, and provides a research per-
ceptive.  A distinction between established and emergent
functions of teams is made and the implications for
research enumerated.

Bowen, D. D. and Siegel, J. P. Process and performance: A longitudinal study of the reactions of small task groups to periods performance feedback. Human Relations, 1973, 26, 433-448.

Study involved 86 M.B.A. students (85 males and 1 female) divided into 20 four-person and 2 three-person groups and measures of group performance on five 5-7 page papers by each group and questionnaire. Purpose of study was to replicate Zander's findings (1971). Findings confirmed on perceived group effectiveness, own role satisfaction and own part in group satisfaction, and motivation increases over time. Contradicting findings found regarding group effectiveness, perceived group performance and personal involvement, and group attractiveness.

Bowser, Samuel E. Determination of criteria of operational unit effectiveness in the U. S. Navy. TR 76TQ-41. San Diego, California: Navy Personnel Research and Development Center, August 1976.

The criteria for evaluating organizational effectiveness are considered within a system framework. A general review of the literature is presented. Operational unit management personnel were interviewed and this interview material was content analyzed. The resulting content categories were cross compared by unit type, position in the organization, rank of respondent and question answered. The results show military managers to be performance oriented and supportive of objective type criteria for evaluations. (Author)

Branson, Robert K., Rayner, Gail T., Cox, J. Lamarr, Furman,
    John P., King, F. J. and Hannum, Wallace H. Interservice
    procedures for instructional systems development:
    Executive summary, phase I, phase II, phase III, phase
    IV, and phase V. Tallahassee, Florida: Center for
    Educational Technology, Florida State University, August
    1975.

This report is a five volume set of procedures developed for the
preparation of curriculum for interservice training. The
procedures address five major phases, which are: analyze, design,
develop, implement, and control. The procedures begin with
methodology for conducting a job analysis for the curriculum
subject area for which the instruction is to be developed and
goes through 18 additional steps suitable for the empirical
development of interservice training.

Briggs, G. E. and Johnston, W. A. Team training. Technical
    Report 1327-4. Orlando, Florida: Naval Training Device
    Center, June 1967.

This is the final report on a four-year (1964-1967) contract
program of laboratory research at the Ohio State University on
team training in a combat intelligence center context. The
research literature on team training is reviewed and a set of
conclusions is drawn with regard to team performance as a
function of task, training, and communication variables. The
implications of this research are presented with regard to a
specific team training device. The appendices contain full
descriptions of three laboratory studies not reported previously
in the literature.

Campbell, John P. Personnel training and development. In
    Mussen, Paul H. and Rosenzweig, Mark R. (Eds.). Annual
    Review of Psychology, Palo Alto, California: Annual
    Reviews Inc., 1971, 22, 565-602.

This first review of the personnel training and development areas
covered 3-5 years prior to 1971 for primary reference sources.
Noting that "by and large, the training and development literature
is voluminous, nonempirical, nontheoretical, poorly written, and
dull," Campbell discusses models, theories and the training
problem; new developments in technique; evaluation methodology;
empirical research; and concluding remarks which cite internal
and external reasons why the field has not realized its potential.

Carson, R. C.   Interaction concepts of personality. Chicago:
     Aldine, 1969, 93-171.

In his analysis of varieties of interpersonal behavior, Carson
reviews the work of Roger Brown, Borgatta, Cottrell and Mann,
Lorr and McNair, and most particularly Timothy Leary in the
field of interpersonal behavior.  He identifies a set of
categories of social behavior and indicates that for each cate-
gory there seems to be an identifiable and finite range of
complementary behaviors, resulting in a "reward" or "cost" for
the individuals involved.  In discussing negotiating inter-
personal transactions, Carson further analyzes theories of
interpersonal relations building upon the work of Thibaut and
Kelley, and Homans.  He examines the exchange view of such
interaction as a bargaining relationship where hedonistic
outcome is calculated in terms of rewards, cost, and a concept
of net magnitude (rewards minus costs).

Cartwright, D. and Zander, A. (Eds.).  Group dynamics research
     and theory.  New York: Harper & Row, 1968.

This book is divided into seven parts as a revision to previous
editions to provide a systematic summary of a growing body of
research.  This third edition contains the same structures as
previous editions but the substance of the book reflects reports
of recent efforts to subject early work to the test of a repli-
cation and extension to new types of population or situation.
Theoretical and social origins of group dynamics, theoretical
and methodological approaches and issues, a large body of
empirical findings, principles and needs are included.

Chesler, David J.   Computer-assisted performance evaluation for
     Navy anti-air warfare training: Concepts, methods and
     constraints.  Research Report SRR 71-25, San Diego,
     California: Navy Personnel and Training Research Laboratory,
     May 1971.

Report formulates a general methodological approach for advanced
development of computer-assisted evaluation of trainee perfor-
mance in the computer-based simulation environment, i.e., Navy
Tactical Advanced Combat Direction and Electronic Warfare
(TACDEW) system.  A six-step performance evaluation development
methodology is presented together with a review of pertinent
performance research.

Chesler, David J.  Application and utilization of training
    aids and devices:  Simulated exercises and trainee per-
    formance evaluation.  Research Report SRR73-7, San Diego,
    California: Navy Personnel and Training Research
    Laboratory, September 1972.

This final report of Navy advanced development project,
"Application and Utilization of Training Aids and Devices:
Simulated Team Exercises-Performance Evaluation," summarizes
the conceptual model, nine-step exercise design and six-step
performance evaluation methodology developed and applied in
formulating performance data requirements.  Various operational
and administrative constraints in conducting this kind of
demonstration are enumerated.

Chow, Esther Ngon Ling-Ester and Billings, Carmela.  An
    experimental study of the effects of style of supervision
    and group size on productivity.  Pacific Sociological
    Review, 1972, 15(1), 61-82.

This experiment involved small groups (3's and 4's) of female
college students assembling molecular models.  The findings
supported the hypotheses that: (1) personal supervision
improves productivity; (2) personal supervisor should be more
likeable than impersonal one; and (3) the size-of-group
variable was found to be operative.

Collins, Barry E. and Raven, Bertram H.  Group structure:
    Attraction, coalitions, communication, and power.  In
    Lindzey, Gardner and Aronson, Elliot (Eds.).  The
    handbook of social psychology.  Reading, Massachusetts:
    Addison-Wesley Publishing Company, 1969, 4, 102-204.

The authors provide a comprehensive review and assessment of
the psychological aspects of group structure theory, models,
dimensions, variables, empirical investigations, focusing on
interpersonal attraction, coalitions, communication nets, and
power.  The problems of classification, organization and
coding of the large number of items in the literature were not
fully resolved and the need for a system of classification is
emphasized.

Cooper, Cary L. (Ed.). Theories of group processes. London: John Wiley & Sons, 1975.

Contains ten articles on the social and psychological problems of the interrelationship between the individual, the various groups of which he is a member, and the organizational environment within which he and his groups function. The focus of the book is on theory building in the understanding of these processes for large and small groups, with particular reference to experimental group processes. Substantive areas include learning environments, experiential learning, intensive groups, consciousness-raising, team building, interpersonal trust, sensitivity training, leadership, equality in groups.

Copperman, Norman and Dorian, Paul Asa. Using CAI to measure team readiness. Orlando, Florida: Proceedings of Ninth NTEC/Industry Conference, "Readiness Through Simulation," 9-11 November 1976.

The authors describe the first phase of a two phase program to improve Anti-Submarine Warfare team training. Phase I involves the development and evaluation of a scoring system based upon objective criteria for evaluating ASW team performance. Phase II will include development of a variety of standardized, computer-based problem scenarios for use with the 14A2 training device.

Cummins, R. C. and King, D. C. The interaction of group size and task structure in an industrial organization. Personnel Psychology, 1973, 26, 87-94.

Studying first line supervisors and their groups in a manufacturing plant, groups ranging in size from 10-37 with an average of 21 were evaluated on high structured and low structured tasks. For high structure tasks, large groups have higher productivity and better relations. In low structure tasks, there was a non-significant but negative correlation between group size and productivity and relations.

Davis, James H. Group performance. Reading, Mass.:
    Addison-Wesley Publishing Company, 1969.


The organizing theme in this small book is the comparison of
individuals with groups in various circumstances of performance.
Davis' view is that the translation of individual task behavior
into group performance is an important aim of social theory and
research. The technical emphasis is on social interaction
processes and social combination schemes (baselines) for trans-
lating member contributions to the task into a group product.
Variables emphasized as affecting performance are categorized
under group size, composition, cohesiveness and structure, the
latter defined as a pattern of interpersonal relations.


Davis, James H. Group decision and social interaction:  A
    theory of social decision schemes. Psychological Review,
    80(2), 1973, 97-125.


This paper proposes a general theory for many kinds of group
decision making and illustrates some special case models.  While
focusing on the traditional issue of individual-group
differences, the theory is aimed at accounting for the distri-
bution of group decisions by using formal hypotheses about the
effects of social interaction when the inputs to discussion are
individual member preferences.


Defense Documentation Center. Team training: A report
    bibliography. Alexandria, Virginia, December 1976.


This bibliography report on team training covered the period
1974-1976.  A small number of projects is reported, a few of
which are tangentially relevant to team training.

Defense Documentation Center. Team training: Work unit summaries. Alexandria, Virginia, 15 December 1976.

This tabulation of DoD Work Unit Summaries covered the period 1971-1976. Eighteen first level search terms and five second level terms related to training and group performance were used. The search identified few on-going or completed research efforts in team training.

Defense Science Board. Summary report of the task force on training technology. Washington, D. C.: Office of Director of Defense Research and Engineering, 22 February 1976.

Report contains findings, conclusions and recommendations of the Task Force studies conducted between July 1974 and June 1975. Report places considerable emphasis on the need for cost-effectiveness analyses of training, and the benefits or potential benefits that could accrue from the timely implementation of training technology research and development findings. Crew, group, team and unit training requirements are emphasized.

Eckstrand, Gordon A. Current status of the technology of training. Training Research Division, Behavioral Sciences Laboratory, Wright-Patterson Air Force Base, Ohio. Presentation at the 72nd APA Annual Convention, Los Angeles, California, September 4-9, 1964.

The author presents a brief overview of the status of the technology of training and indicates where further improvements would make major contributions to training efficiencies. The paper includes discussion of the general status of training technology; the processes involved in designing a training system presented in terms of determining training requirements, developing the training environment, and measuring the results of training; and enumeration of promising research areas. The conceptual orientation is on the systems approach to training.

Egerman, Karl. Effects of team arrangement on team perfor-
mance. Journal of Personality and Social Psychology,
May 1966, 3(5), 541-550.

Egerman studied two-man teams, the members of which were first
trained individually, then as team members. He found that
(1) preteam measures of individual proficiency entered into
appropriate probability formulae provide accurate predictions
of initial team performance;(2) feedback linkages were observed
in each of the team arrangements; (3) feedback parameters were
found to be related to the probability of feedback linkages;
(4) reinforcement schedules depend on individual proficiencies
and team assignment; (5) changes from initial to final team
performance may be anticipated on the basis of reinforcement
schedules.

Eityn, D. Stanley. The effect of group structure on the
success of athletic teams. International Review of Sport
Sociology, 1973, 8(1), 7-17.

Using questionnaires sent to coaches of high school basketball
teams, the author found a moderate but consistent relationship
between homogeneity of the group and the absence of cliques,
and a definite relationship between the existence of cliques
and winning percentages.

Erez, Miriam. Feedback: A necessary condition for the goal
    setting-performance relationship. Research Report No.
    10. ONR Contract No.N00014-75-C-0884. College Park,
    Maryland: University of Maryland, 1976.


The study focused on feedback as a necessary condition for
goals to affect performance and predicted that feedback and
goals would be interactively related to performance. Also,
it was suggested that the interaction of feedback and self
goals be viewed as an individual x environment interaction
model. Results supported the hypothesis that feedback would
facilitate the display of individual differences in self-set
goals and hence, the self-set goals-performance relationship.
Individual differences in self-goals were significantly higher
in the feedback group, than in the no feedback group, and in
the feedback condition the relationship between goals and
performance was significantly higher than in the no feedback.


Federico, Pat-Anthony. Computer simulation: A technique for
    studying psycho-social and sociotechnical systems.
    TN 76-3. San Diego, California: Navy Personnel Research
    and Development Center, January 1976.


From a comprehensive literature review the author concluded
that computer simulation methodology can be used to overcome
obstacles impeding man's understanding of, and scientific
advancement in, psycho-social and sociotechnical systems. He
views many investigations identified as demonstrating the
feasibility of using simulation techniques to analyze and
synthesize organizational systems. Finally the accrued
advantages and potential payoffs resulting from using simu-
lation techniques are viewed as far outweighing any pitfalls
that may be encountered in their implementation.

Frank, Frederic and Anderson, Lynne R.  Effects of task and
    group size upon group productivity and member satisfaction.
    Sociometry, 1971, 34(1), 135-149.

Comparisons were made among small groups of various sizes on
conjunctive and disjunctive tasks in a test of Steiner's model
for predicting the interaction of group size and task size.
Results showed increases in group size enhanced quantitative per-
formance on disjunctive tasks but were detrimental to performance
on conjunctive tasks.  A direct relationship was found between
"pleasantness" and "enjoyment" of the tasks.  Disjunctive tasks
were found to produce more satisfaction, and odd-sized groups
were generally more satisfied than even-sized groups.

Gagné, Robert M. (Ed.).    Psychological principles in system
    development. New York: Holt, Rinehart and Winston, Inc., 1962.

This book is presented as the first of its kind, marking the coming
of age of a "systematic conception of the application of psycho-
logical principles to the invention, development, and use of
complex man-machine systems."  Fourteen chapters cover a variety of
topics discussed in terms of a theory of psychotechnology within a
systems context.

Gibbard, G. S., Hartman, J. J. and Mann, R. D. (Eds.).  Analysis
    of groups.  San Francisco: Jossey-Bass, Inc., 1974, 1-12.

The authors examine the strategies of observation and analysis
noting that small group research has concerned itself with two
major issues:  (1) development changes in group process and
structure, and (2) the role of individual "leaders" or "role
specialists" in dictating the direction of social change.  They
believe methodological strategies in small group research can be
described as "clinical" (hedgehogs) and "statistical" (foxes),
plus a third approach "hybrid" (hedgefoxes).  Leading researchers
are categorized and their approaches analyzed.  The position is
taken that the ultimate answer to questions of optimum metho-
dologies and their use lies in the needs, values and particular
questions of the individual researchers.  The authors "have simply
stated the alternatives."

Glanzer, Murray. Experimental study of team training and
team functioning. In Glaser, Robert (Ed.) <u>Training
research and education</u>. Pittsburgh: University of
Pittsburgh Press, 1962, 379-407.

This chapter reports on a program of research on team
training and reviews field investigations of team operation
and experimental laboratory studies on the functioning of
teams and small groups. The implications of these investi-
gations for team training are discussed including several
problems associated with training and research. The view
presented is that research on team training procedures
should investigate the reinforcement feedback conditions
supplied to each team member as a function of team
organization leading to the study of reinforcement con-
tingencies that influence learning in the way they are
studied in investigations of individual learning.

Glanzer, Murray and Glaser, Robert. Techniques for the study
of group structure and behavior: Part I. Analysis of
structure. <u>Psychological Bulletin</u>, September 1959,
56, 5.

The work on the structure of groups, with an emphasis on
communication structure, was examined. Mathematical tech-
niques growing out of sociometry are the focus. The authors
point out that the techniques permit the analysis of a much
wider variety of organizational relationships than hitherto
studied, but in most cases they will probably be helpful only
in clarifying the requirements for adequate descriptive or
explanatory systems. They note that the task of constructing
theories concerning the behavior of groups remains.

Glanzer, Murray and Glaser, Robert. Techniques for the study of group structure and behavior: Part II. Empirical studies of the effects of structure in small groups. Psychological Bulletin, January 1961, 58, 1.

This paper reviews laboratory studies in which experimenters imposed different communication structures on groups and measured the effect of the structures on performance. The authors trace the development of research on the effects of group structure beginning with Bavelas (1948) through to Rosenberg and Hall (1960). The authors note that "at the present time, there is still a major need for a system to order the data already obtained and to direct further work on the effects of group structure."

Greller, M. M. Process and effectiveness: A survey of small group research findings. Unpublished manuscript, New Haven, Conn.: Yale University, Department of Administrative Sciences, October 1972.

This paper points out several trends in the social psychology literature dealing with ways in which group processes may be influenced to effect productivity. Research on T-Groups, the "developmental leader," Roby's "executive function," laboratory education, and related works are discussed. Greller cites the "crying" need to abstract the essence from research in leader-based and process interventions to determine their utility and the character of the situations in which they are useful.

Hackman, J. R. and Kaplan, R. E. Interventions into group processes: An approach to improving the effectiveness of groups. Decision Sciences, 1974, 5, 459-480.

The authors examined process interventions involving changes in both group norms and actual behavior of group members using productivity tasks. Results obtained indicated that the interventions do change group behavior with demonstrable effects on group performance and members' experience. The authors point to the sterility of the test environment and the need for systematic research in the more complex environment of on-going organizations.

Hackman, J. R. and Morris, C. G.  Group tasks, group
    interaction process, and group performance effective-
    ness:  A review and proposed integration.  _Advances
    in Experimental Social Psychology_, 1975, 8, 47-99.

Group effectiveness is seen to depend on interaction among
the members of the group while they are working on a task.
The authors attempt to identify, measure, and change the
aspects of group interaction.  Section I is a review of
previous research.  Section II is (1) a study of how group
interaction enhances or depresses group effectiveness;
(2) the formulation of strategies for influencing group
interaction and group performance by alteration of "input"
factors; and (3) a call for further research in understand-
ing the factors that go into group effectiveness and how to
improve it.  Section III - The arguments for research are
more fully developed and suggestions are made for action-
oriented research in particular.

Hackman, J. Richard and Vidmar, Neil.  Effects of size and
    task type on group performance and member reactions.
    _Sociometry_, 1970, 33(1), 37-54.

This study explored the effects of the size of the group and
the type of task on the reaction of the members and on per-
formance.  Subjects were 35 students.  It was found that
dyads yield greatest satisfaction for the members and that
dissatisfaction increases roughly with group size.  Subjects
found production tasks most difficult and stressful and
problem solving tasks most relaxed.  Contrary to expectation,
no interaction was found between group size and task type in
predicting behavior.

Haines, Donald B.  Training for group interdependence.
    AMRL-TR-65-117.  Aerospace Medical Research
    Laboratories, Wright-Patterson Air Force Base,
    Ohio, January 1965.


Small teams and crews working together in intimate coordina-
tion are the key to many USAF missions today and effective
team performance may depend upon member interdependency
within the group.  An adequate training program requires
understanding of the ways in which men work together in
closely-knit groups.  Goal and means interdependency in
group process has long been a focus of interest for social
psychologists.  Current research and theory thus may pro-
vide useful guidelines for applications of group inter-
dependency principles to military crew situations (particu-
larly that of the American military advisor working with his
foreign counterpart).  The concepts of goal and means inter-
dependency are defined, the controversy between current
exponents of cognitive and stimulus-response (S-R) theory is
examined for its contribution to understanding group inter-
dependency phenomena, the recent adaptation of the theory
of games is reviewed, and suggestions are made for the
development of experimental training programs which will
furnish insights into the nature of group functioning.
(Author)


Hall, R. L.  Group performance under feedback that confounds
    responses of group members.  Sociometry, 1957, 20,
    297-305.


Using a task involving learning to turn a concealed knob a
required number of turns during a timed interval, Hall
investigated the performance of two man teams with KOR pro-
vided to each team member which was a single team score that
combined the responses of both members.  Pretraining under
direct vs. confounded feedback and the relative weighting
of the responses of the two subjects when feedback was
confounded were the two experimental variables considered.
Hall found that teams pretrained on confounded feedback
improved their accuracy at a greater rate than teams
trained on individual feedback.  Error compensation by
team members was put forth as accounting for the results.

Hall, E. R. and Rizzo, W. A.  An assessment of U. S. Navy
    tactical team training.  TAEG Report 18.  Orlando,
    Florida:  Navy Training Analysis and Evaluation Group,
    March 1975.

This study report compiled information for planning and
development of improved team training practices, pro-
cedures and associated hardware, and for resource management
in the U. S. Navy.  Specific objectives of the study
included:  (1) describe and assess the status of team
training, (2) review and critically evaluate findings in the
technical literature regarding team training, and (3) develop
and recommend potential solutions to team training problems.

Hall, Joy and Williams, Martha S.  Group dynamics training
    and improved decision making.  Journal of Applied
    Behavioral Science, 1970, 6(1), 39-68.

In an experiment testing the efficiency of laboratory train-
ing in group dynamics as a technique for modifying group
processes toward theoretically more effective practices,
data were analyzed on both process and performance criteria.
Results indicated that trained groups consistently performed
better than untrained groups on measures of decision quality,
utilization of superior resources and creativity.

Hare, A. Paul.  Bibliography of small group research: 1959-
    1969.  Sociometry, 1972, 35, 1-150.

This bibliography covers the period 1959 through 1969 with
a few items from 1970 and 1971.  As the fourth biblio-
graphy by the author, the present listing concentrates on
laboratory and field studies where observation was
rigorously controlled.  The categories in the index are the
same as those used for organizing chapters in Hare's 1962
Handbook of Small Group Research.  New categories were
created for topics on which there was a significant increase
in the amount of research such as social exchange,
competition in two-person games, and the risky shift
phenomenon.

Hare, A. Paul. Handbook of small group research. New
    York: The Free Press, 1976.

This revision of the 1962 handbook summarizes the major
trends and findings in theory and research on small groups
from 1898 through 1974 with more than 6,000 references.
The book is organized in three parts: (1) interaction and
group structure, (2) factors which can produce changes in
group norms, the interaction process, the role system,
and the pattern of interpersonal choice, and (3) a summary
of the literature from the point of view of productivity.
Four appendices provide information on small group
experiments, the history of small group research, the most
commonly-used research methods, and an overview of group
dynamics in sensitivity training and related areas.

Hare, A. Paul, Borgatta, Edgar F. and Bales, Robert T. (Eds.).
    Small groups: Studies in social interaction. New
    York: Alfred A. Knopf, 1955.

This book is divided into four parts. Part I is concerned
with historical and theoretical background of the field.
Part 2 is a collection of studies which view the social
process from the perspective of the single individual in a
social situation. Part 3 contains studies focused on ex-
ternal observations of the group as a system of social
interactions and describing its characteristics. Part 4
is an annotated bibliography of 580 titles.

Helmreich, Robert, Bakeman, Roger and Scherwitz, Larry.
    The study of small groups. In Mussen, Paul H. and
    Rosenzweig, Mark R. (Eds.), Annual Review of Psychology,
    Palo Alto, California: Annual Reviews Inc., 1973, 24,
    337-354.

This review covers the period 1967-1972. The review
includes sections on methodology, attraction, conformity
and social influence, cooperation and competition, perfor-
mance, social facilitation, task performance, risky shift,
leadership, environmental psychology, encounter groups,
and a postscript. The authors state "summarizing the
research reviewed (or not reviewed) in an area as diverse
and loosely linked as the study of small groups is a
practical and theoretical impossibility."

Hewett, T. T., O'Brien, G. E. and Hornik, J. The effects
of work organization, leadership style, and member
compatibility upon the productivity of small groups
working on a manipulative task. Organizational
Behavior and Human Performance, 1974, 11, 283-301.


Defining collaboration (when members share responsibility
for some tasks) and coordination (no overlap of tasks and
definite precedence relations) and using a task of con-
structing molecular models, 96 undergraduates were
divided into groups of three-persons, all-male or all-
female. Group leaders had high or low LPC scores. Groups
had high or low compatibility. Dependent variables were
quantity and quality of models. Coacting groups (all
work done individually) and coordination groups were
most productive. Collaboration groups were least produc-
tive.


Hinton, W. M. and Fishburne, R. P., Jr. Performance
oriented aircrew training: Optimization through
ISD. Orlando, Florida: Proceedings of Ninth NTEC/
Industry Conference, "Readiness Through Simulation,"
9-11 November 1976.


The authors describe their approach in employing traditional
and modified Instructional System Development techniques
to develop a training program for E-2C aircrew training with
a greater emphasis on a "system" orientation and an
appreciation for the interactive nature of the development
steps. Two instructional approaches were developed and are
described: tape/slide presentation with self-scoring
answer sheets, and a computer-managed instructional system
for possible future use.

Howard, Ann.  Intrinsic motivation and its determinants
    as factors enhancing the prediction of job perfor-
    mance from ability.  College Park, Md.: Univ. Md.,
    Research Report No. 11 (ONR Contract No.N00014-75-
    C-0884), May 1976.

Purpose of this research was to explore the relationship
of ability and intrinsic motivation in the prediction
of job performance.  Two determinants of intrinsic
motivation were traced:  an organizational factor and an
individual difference factor.  Data was collected on
335 clerical employees in 11 job groups in a large
metropolitan bank.  Ability and intrinsic motivation com-
bined in an additive but not in an interactive way in
predicting job performance.  It was suggested that
intrinsic motivation is a useful construct that is not
yet well measured.

Ingham, A. S., Levinger, G., Graves, J. and Peckham, V.
    The ringelmann effect: Studies of group size and
    group performance.  Journal of Experimental Social
    Psychology, 1974, 10, 371-384.

These studies, using undergraduates as subjects and team
rope-pulling as the problem, tested the effects of
increasing the size of the team on performance, and
factors influencing reduced motivation.  Adding two men to
single puller reduced efficiency by 18% with further
additions having no significant effect.  Reduced motivation
viewed as possibly due to no feedback.  Improved motivation
could result from measuring individual team members'
efforts if member informed of measuring.

Insko, Chester A. and Schopler, John.  Experimental social
    psychology.  New York: Academic Press, 1972, 379-548.

This review of the research literature on small groups
emphasizes how groups work.  The review begins with pre-
interaction variables, moves to group organization or
internal variables, then to group decisions and intergroup
relationships.  The focus is on the end products of group
interaction rather than on a specific set of independent
variables.

James, L. R. and Jones, A. P.  Organizational climate:
A review of theory and research.  Psychological
Bulletin, 1974, 81, 1096-1112.

Previous organizational climate research, definitions, and
measurement approaches are reviewed and differentiated into
three categories: namely, a multiple measurement-organiza-
tional attribute approach, a perceptual measurement-organi-
zational attribute approach, and a perceptual measurement-
individual attribute approach.  Similarities and differences
between these approaches are discussed in an attempt to
address a number of theoretical and psychometric concerns.
A major focus is the extent to which organizational climate
duplicates other organizational and individual domains.
Recommendations are made for future research which include
a rationale for differentiating between organizational
climate and psychological or individual climate and an
emphasis upon the distinction between level of measurement
and level of explanation as related to future definitions
of climate. (Authors)

Johnson, Steven L.  Establishing training criteria on an
economic basis. Orlando, Florida: Proceedings of
Ninth NTEC/Industry Conference, "Readiness Through
Simulation," 9-11 November 1976.

The author presents a quantitative (Bayesion economic
analysis model) and a communicable framework for
establishing training effectiveness criteria for use by the
training specialist and the manager.  The applicability of
techniques developed in the areas of quality assurance,
training technology and decision theory is discussed.

Jones, Allan P., Hornick, Christopher W. and Sells, S. B.
  A social systems analysis of the naval organization:
  Organizational characteristics and effectiveness of
  naval ships.  IBR Technical Report No. 72-15, ONR
  Contract No. N00014-72-A-0179-0001, Fort Worth,
  Texas:  Texas Christian University, Institute of
  Behavioral Research, 31 August 1972.

Organizational characteristics of naval ships were examined
within the context of a social systems model consisting
of eight major components:  1) objectives and goals,
2) philosophy and value systems, 3) personnel composition,
4) organization, 5) technology, 6) physical environment,
7) social-cultural environment and 8) temporal character-
istics.  The initial phase of investigation involved
description and quantification of selected system elements
and of perceived dimensions of organizational climate.
Interrelated measurement approaches employed in this phase
consisted of organizational climate questionnaires and
structured interviews with ship officers.  Detailed infor-
mation on environmental factors included such factors as:
chain of command, differentiation by subgroups, procedural
flexibility, role structure, mission objectives, communi-
cation channels, and policies.  Data on organization
structure and function was obtained through Organizational
Climate Questionnaires.  Typical factors included were:
organizational clarity, support of subordinates by
supervisors, communication-downward, atmosphere of trust
and efficiency to work.  Differences in climate dimension
scores from four minesweepers were related to other
differences between the ships.  The structure obtained
from these ships were compared to structure obtained in
previous studies of other organizations.

Kelley, Harold H. and Thibaut, John W. Group problem solving. In Lindzey, Gardner and Aronson, Elliot (Eds.) The handbook of social psychology. Reading, Mass.: Addison-Wesley Publishing Company, 1968, 4, 1-101.

The authors present several models relating to group problem solving and process, each model providing a standard with which experimental results may be evaluated. Discussion includes the models of Leavitt, Lorge and Solomon; Buchanan and Tullock; and Siegel and Fouraker among others. Research findings on the contrast between group behavior and individual behavior as influenced by the type of problem, pressures toward conformity, and the characteristics of the groups and individuals themselves are reviewed and generalizations drawn.

Kidd, J. S. A comparison of one-, two-, and three-man work units under varying conditions of work load. Journal of Applied Psychology, 1961, 45, 195-200.

Comparative analysis was made of the effect of input load and team size on the productivity of a radar approach control unit. Nine laboratory trained controllers participated in a total of 54 problems. Unit size was varied by using one, two and three operators per unit. Results confirmed previous findings that performance falls off sharply as load is increased. Reducing load per controller by increasing team size leads to only moderate increase in performance. No reliable prediction of team performance was observed on the basis of four predictor variables derived from individual performance indices. System efficiency and safety were performance measures applied.

Klaus, David J. and Glaser, Robert. Increasing team proficiency through training: 8. Final summary report. ONR Contract Nonr. 2551(00) (NR 154-079). Team Training Laboratory, American Institutes for Research, 1968.

This summary describes a series of seven studies conducted at the Team Training Laboratory, American Institutes for Research during 1960-1967. The study areas included (1) reinforcement of team responses, (2) team acquisition and extinction, (3) decrements in parallel teams, (4) effects of team arrangement, (5) team composition and membership, (6) use of supplemental reinforcement, and (7) simulation of a team environment. The authors cite the possible parallels to this team research in social psychology.

Klaus, D. J. and Glaser, R. Reinforcement determinants of team proficiency. Organizational Behavior and Human Performance, January 1970, 5(1), 33-67.

This summary describes a series of seven studies conducted at the Team Training Laboratory, American Institutes for Research during 1960-1967. The study areas included (1) reinforcement of team responses, (2) team acquisition and extinction, (3) decrements in parallel teams, (4) effects of team arrangement, (5) team composition and membership, (6) use of supplemental reinforcement, and (7) simulation of a team environment. The authors cite the possible parallels to this team research in social psychology.

Koch, James L. Effects of feedback on job attitudes and work behavior: A field experiment. Technical Report No. 6. ONR Contract No.N00014-76-C-0164. Eugene, Oregon: College of Business Administration, University of Oregon, October 1976.

This study examined the effects of feedback on job attitudes and work behavior among a sample of female sewing machine operators. Increased feedback led to significant improvements in the group cohesion and goal commitment of the operators. Moreover, marked improvements in product quality were associated with feedback from management. Turnover and absenteeism also decreased, but overall satisfaction did not increase and intrinsic job satisfaction actually decreased. Operator work expectations increased as a result of their involvement in this field experiment. Findings are discussed with reference to theoretical and practical issues in work systems redesign.

Landers, Daniel M. and Lüschn, Günther. Team performance outcome and the cohesiveness of competitive coacting groups. International Review of Sport Sociology, 1974, 9(2), 57-71.

In this study of interacting and coacting groups, questionnaires were used with 52 intramural bowling teams. It was found that bowling skill was correlated with success; that interpersonal attraction among team members was highly correlated with failure in step down analysis; and that communication between members between games correlated with success but had a high standard deviation.

Larson, O. A., Sanders, S. I. and Steinemann, J. H.
    Survey of unit performance effectiveness measures.
    Technical Report 74-11.  San Diego, California:
    Navy Personnel Research and Development Center,
    January 1974.

The report provides the results of a survey conducted to
determine the state-of-the-art of performance assessment
systems and methodologies to support requirements for
improved combat unit training in the U.S. Marine Corps.  A
101-item annotated bibliography is provided.

Leih, Robert K. and Curry, Timothy J.  On integrating small
    group concepts and models.  Pacific Sociological
    Review, 1971, 14(1), 38-52.

This paper proposes a series of concepts pertaining to
operant-oriented work, decision processes and personal
strategy, bargaining and exchange relations, and more general
notions such as norms leading to different types of structures.
By means of these concept definitions different types of
models can be integrated and a wide variety of small group
research can be given theoretical continuity.

Lindgren, Henry C.  Contemporary research in social psychology:
    A book of readings.  New York: John Wiley & Sons, 1973.

The "samples" of papers includes consideration of both the
scientific foundations and everyday relevance of social
psychology research.  Social attraction, social learning, social
influence, personality, social perception, social status,
communications, group process, leadership and the dynamics of
aggression are included.

Lorge, I., Fox, David, Davitz, Jack, and Brenner, Marlin. A survey of studies contrasting the quality of group performance and individual performance 1920-1957. Psychological Bulletin, 1958, 55, 337-372.

This analysis of studies contrasts the quality of performance by individuals and groups in diverse situations. A classification scheme presented for a variety of groups includes (1) interacting face-to-face group divided into traditional and ad hoc,(2) noninteracting face-to-face divided into climatized and social climatized, and (3) noninteracting non-face-to-face group divided into statisticized and concocted. Judgment, memory, size of group, social facilitation, etc. are included but the principal emphasis is on productivity. A wide range of methodological issues is discussed.

Lundgren, David C. Trainer style and patterns of group development. Journal of Applied Behavioral Science, 1971, 7(6), 689-709.

Developmental trends in two 10-man training groups were studied by checklist and rating scale techniques over four days laboratory session. Groups varied by trainer attitude; inactive and nondirective at outset vs. active and directive at outset. Results show significant differences in solidarity, openness and productivity of groups - the groups with nondirective, inactive leaders being most productive.

Martens, Rainer and Peterson, James A. Group cohesiveness as a determinant of success and member satisfaction in team performance. International Review of Sport Sociology, 1971, 6, 49-61.

Questionnaires were used with intramural basketball teams to measure cohesiveness. The number of games won was used as the measure of effectiveness. Cohesiveness was found to be an important factor in team effectiveness. Higher levels of cohesiveness are associated with greater success and satisfaction. Discusses methodological problem of adequately defining cohesiveness and equivocal nature of the data on team effectiveness.

McGrath, J. E. and Altman, I. Small group research: A synthesis and critique of the field. New York: Holt, Rinehart and Winston, 1966.

Part I sets forth the classification system developed and revised by the authors to describe and integrate small group research information. They apply this system to a sample of nearly 250 studies selected from a bibliography of over 2,000 entries and discuss its broader application. Part II contains a description of empirically established facts and generalizations, gaps in the field, methodological problems, and perspectives on the cultural milieu in which small group research is carried on. Part III contains reference materials designed to aid small group researchers in review of the literature, identification of worthwhile research topics and study design.

Meister, David. Behavioral foundations of system development. Chapter V - Team functions. New York: John Wiley, 1976, 231-296.

Since the team is the most obvious feature of the multiman system, one cannot understand that system without considering the team. It follows then that one must know how individual operators are integrated into the team. These processes determine what team training will consist of and how it will be conducted. Concepts about team processes and team training have been fuzzy, focusing on crew communications. A good deal of research effort has been expended on determining whether team training results in performance improvement, and the results have been disappointing. The literature describing structural team variables (e.g., crew size, organization, and composition) is also reviewed. (Author)

Miller, Mark M. Task orientation and salience as determinants of source utility. Journalism Quarterly, 1972, 49(4), 669-673.

In this study forty-three students were divided into four groups to test salience and task orientation as determinants of source utility. Salience proved to predict source utility best, even under conditions of high task orientation.

Naylor, J. C. and Briggs, G. E. Team training effectiveness under various conditions. J. Appl. Psychology, 1965, 49(4), 223-229.

Transfer performance of three-man teams was measured as a function of two-system variables (task complexity and organization) and one training variable (skill level of a replacement for one of the team members) in a simulated radar control serial intercept task. Each independent variable influenced team performance. Task complexity had a consistent effect across all transfer sessions with superior performance on the less complex task. Task organization influenced performance only after the replacement occurred with superior performance by teams organized to permit each subject to work independently of his counterpart. The teams receiving a more highly trained replacement improved in performance immediately following; teams with a less skilled replacement actually deteriorated slightly but then recovered in a subsequent work period.

Nebeker, D. M., Dockstader, S. L. and Vickers, R. R., Jr. A comparison of the effects of individual and team performance feedback upon subsequent performance. Technical Report 75-35. San Diego, California: Navy Personnel Research and Development Center, May 1975.

This study sought to determine the effects of performance feedback presented to subjects acting singly or as members of a team. The experimental questions addressed were: (1) whether being identified as a team member enhances performance and (2) whether individual performance in groups is affected by variation in the amount and specificity of the feedback provided. Results indicated that subjects who perceived themselves as part of a team did not perform at significantly higher levels than non-team members, when the effects of feedback were controlled. Results also revealed that, although individuals performed better with than without feedback, it didn't matter whether the feedback was raw or percentile or whether it concerned the individual, his group, or both.

Nogami, Glenda Yukie.   The effects of room size and group size
    on individual vs. group task performance.   Technical
    Report 25, ONR Contract No. N00014-67-0226-0030.
    Lafayette, Indiana: Purdue University, April 1975.


Four and ten person groups of males and females were placed
into 70, 40 or 16 square foot rooms.  Working either as a group
(interacting) or individually (co-acting), they performed a
perceptual task and a problem solving task.  Results indicate
that there is no difference in problem solving from dense to
less dense areas, replicating Freedman, Klevansky and Ehrlich's
findings (1971).  However, there appear to be mood and attitude
differences from dense to less dense conditions, and a sex
difference.  With density constant (area per person), males
appear to be more affected by group size while females are
affected by the interaction of the room size and group size.


Obermayer, Richard W., et al.   Combat-ready crew performance
    measurement system study.   AFHRL Final Report of Contract
    No. F41609-71-C-0008, Air Force Human Resources Labora-
    tory, May 1972.


This study involved development of (1) a systematic definition
of performance measures appropriate to combat-crew training
needs, and (2) definition of a cost-effective measurement
system usable in combat-crew training environments to acquire
and process needed training information.  Data for performance
measures were collected from several USAF bases.  Measurement
system criteria were based on an analysis of combat-crew
training procedures.  Detailed system specifications and an
implementation plan were prepared.  The difficulty in isolating
individual performance for some aircraft crews is cited.

Olmstead, Joseph A. Small-group instruction: Theory and practice. Alexandria, Virginia: Human Resources Research Organization, 1974.


This volume is an analysis of the state of the art of small-group methods of instruction. It describes some of the more commonly used small-group techniques and the rationale behind them, and provides an analysis of their potential use for various types and conditions of instructional environments. Explicit guidelines are provided to assist trainers and training managers in selecting methods that will accomplish desired instructional objectives and in using the methods effectively.


Proskansky, H. M. Environmental psychology and the real world. American Psychologist, 1976, 31, 301-310.


Proskansky sets forth his reasons for his change of interest from laboratory social psychology to the new field of environmental psychology. He defines environmental psychology as "the attempt to establish empirical and theoretical relationships between the behavior and experience of the person and his built environment." Proskansky cites five new methodological requirements for the new field: (1) the absolute integrity of person/physical setting events, (2) the distinction between behavior-systems reactions and psychological system reactions, (3) a context orientation to problems, (4) a time orientation of environmental psychology, and (5) a context orientation in the analysis of problems.

Roby, Thornton B. <u>Small group performance</u>. Chicago:
Rand McNally and Company, 1968.

This monograph sets forth a framework for developing theory
related to task performance in small groups. Aim is to
identify significant variables in performance and to
illustrate research techniques for obtaining necessary
empirical information. The focus is on highly specialized
groups devoid of interpersonal conflict, fully accepting
task objectives and conditions, and guided by agreed upon
operating procedures and member roles developed over a
long period of working together as a team. Within this
limited specification, the analysis attends to group
functional divisions, group rules and strategies and
influence relationships among component processes. Three
hypothesized modes of constructing a performance model -
aggregation, segmentalization, idealization - are explored,
together with techniques such as mathematical and computer
models. Roby concludes that any serious attempt at perfor-
mance prediction must be based upon a computer simulation
and presents a schema of a suggested program of analysis.

Roby, T. B. and Lanzetta, J. T. Considerations in the
analysis of group tasks. <u>Psychological Bulletin</u>, 1958,
55, 88-101.

Provides a tentative, proposed approach to the problem of
describing and classifying tasks. Four stages of group-
task properties are proposed: task input variables, group
input variables, group output activities, test output
activities, each of which can be broken down as to
descriptive or qualitative nature, distribution of component
events in space, functional behavior of the events.
"Objective" and "modal" task properties are distinguished.
The notion of "critical demands" based on broadly defined
group functions is also presented. The authors note the
general neglect of task parameters in small group research.

Rome, B. and Rome, S.  Communications and large organizations. SDC document SP-1690/000/00.  Santa Monica, California: System Development Corporation, 4 September 1964.

Report describes a number of experiments with a large organization consisting of a team of 20 to 30 members and hundreds of "agents" simulated in a computer.  Real time interaction among subjects through the computer is provided.  Experiments included study of organizational information processing among subsystems, exercise of authority in manpower-utilization, and evaluation of the organization under various experimental manipulations of input load, conflicting demands and KOR. Extrinsic KOR organized by subsystem function was found to be insufficient for team improvement.  Very significant improvement (300 percent) resulted from total system debriefing.  Other experiments involved organizational structure and crises environment changes, and substitution of systems reports by exception for comprehensive feedback.

Rosenberg, S.  A laboratory approach to interpersonal aspects of team performance.  Ergonomics, 1959, 2, 335-348.

Rosenberg tested the hypothesis that in a complex task team members did not learn coordination skills because they had not yet learned the task well enough.  Using individually pretrained subjects assembled in combination with other trained and nontrained subjects, he found no differences in degree of role differentiation and less role differentiation among pretrained members.  He concluded that distribution of responsibility is difficult to develop in complex tasks and this failure is not due exclusively to failure to master the task. These findings point to the need for adequate team training to produce optimal team performance rather than simply assembling individually trained members.

Rosenberg, S.  Cooperative behavior in dyads as a function of reinforcement parameters.  Journal of Abnorm. Soc. Psychology, 1960, 60, 318-333.

Rosenberg studied the effect on team performance of combining feedback in various ways and providing various degrees of specificity of feedback, i.e., whether an error has occurred vs. direction of error.  His results indicated that comparative behavior develops and team performance improves when feedback is specific and when both subjects receive feedback which weights their own responses 50 percent or more.

Rosenberg, S. and Hall, R. The effects of different social
feedback conditions upon performance in dyadic teams.
Journal of Abnormal Soc. Psychology, 1958, 57, 271-277.

Using a knob-turning task and two-man teams, the authors
investigated the effect of three feedback conditions (direct,
confounded and "other") on individual and team accuracy.
"Other" involved feedback on adequacy of their partner's
response. The results for individual accuracy showed that
for rate and ultimate level of learning, direct was superior
to confounded, and "other" showed no learning. When team
accuracy scores are considered, direct and confounded
feedback produce equal learning rates and levels and both
were better than "other" condition. In a replication
experiment, confounded feedback produced a higher level of
learning than direct feedback.

Samuels, Frederick. The intra- and inter-competitive group.
Sociological Quarterly, 1970, 11(3), 391-396.

This study investigated the effect of different types of
reward distribution on group structure. Three-member groups
of each of four different reward-distribution types were
studied. In a task involving circular jigsaw puzzles, it was
found that intra- and inter-competitive groups had the
greatest intra-group like-ability and showed the most positive
behavior.

Shure, G. H., Rogers, M. S., Larsen, I. M. and Lassone, J.
Group planning and task effectiveness. Sociometry,
1962, 25, 263-282.

Using 150 college males divided into 30 five-man groups on
a hidden symbol task, results of this experiment indicated
that groups given a separate planning period between trials
were significantly faster than co-temporal planning or no-
planning period groups. The findings supported the
hypothesis that normal efforts to organize in newly formed
groups is subverted by task pressures creating a sense of
urgency and panic (Cattell's "horde urgency" factor).

Smith, Clagett G.  Scientific performance and the composition
    of research teams.  Administrative Science Quarterly,
    December 1971, 16(4), 486-495.

This study examined the relationships among several dimensions
of team composition and performance of 49 teams in an industry
research laboratory.  Heterogeneous team membership was
associated more frequently with superior success in all
aspects of performance.

Smith, David Horton.  A parsimonious definition of "group:"
    Toward a conceptual clarity and scientific utility.
    Sociological Inquiry, 37(2), 1967, 141-167.

The author identifies necessary and sufficient conditions for
the occurrence of group-like phenomena, presents a definition
of "group," and evaluates the definition in terms of the
criteria of utility, clarity and parsimony for applications
in any given social system.  The definition:  A group is
defined here as (1) the largest set of two or more individuals
who are jointly characterized by (2) a network of relevant
communications, (3) a shared sense of collective identity,
and (4) one or more shared goal dispositions with associated
normative strength.

Smode, Alfred F.  Recent developments in training problems,
    and training and training research methodology.  In
    Glaser, Robert (Ed.).  Training research and education.
    Pittsburgh:University of Pittsburgh Press, 1962,
    437-441, 479.

Reviews new ways of providing learning experiences, new types
of problems or tasks including team training and small group
research.  Emphasizes several needs for information including
how a team functions, relationship between group structure and
operation to team performance, optimum training procedures
for teams in a systems context, and ways of augmenting
information feedback to facilitate performance.

Sorenson, James R.  Task demands, group interaction and
    group performance.  Sociometry, 1971, 34(4), 483-495.


This study investigates the relationships between task demands,
group interaction profiles and group performance through the
use of 28, three-man problem-solving groups.  Guidelines for
study provided by the use of the Collins and Guetzkow model
of processes in decision-making.  Results indicate that task
demands significantly shaped task interaction profiles; task
demands affected only one quality dimension of group perfor-
mance, contrary to previous studies; and that levels of group
performance and task specific behaviors were significantly
correlated.  Sorenson concludes that this research suggests
need for simultaneous study of selected input, process and
output variables.


Sorenson, James R.  Group member traits, group process, and
    group performance.  Human Relations, 1973, 26, 639-655.


One hundred fifty male undergraduates matched for S.A.T.
verbal ability scores were divided into 16 three-man groups
and were required to create a story or poem and solve an
intellectual problem.  Subjects were grouped on the basis of
Remote Associates Test and Social Differentiation scores.
Results indicate group with high S.D. were best on quality
of performance; high R.A.T. best on originality; high
S.D.-R.A.T. best on evaluativeness.


Spoelders-Cloes, Rita.  Small-group effectiveness on an
    administrative task as influenced by knowledge of results
    and sex composition of the group.  European Journal of
    Social Psychology, 1973, 3(4), 389-401.


Two experiments were designed to test E. A. Locke's theory of
task motivation and incentives.  Hypothesis:  Motivational
knowledge of results will influence task performance through
its effects on intentions and goal setting.  Results:  No
significant influence of knowledge of results on small group
effectiveness; no significant influence of sex on effective-
ness.  Both findings support Locke's theory.

Steers, Richard M. Problems in the measurement of organizational effectiveness. Technical Report No. 1. ONR Contract No. N00014-76-C-0164. Eugene, Oregon: Department of Management, University of Oregon, November 1975.

This paper reviews 17 multivariate models of organizational effectiveness in terms of their primary evaluation criteria, their normative or descriptive nature, their generalizability, and their derivation. Little consistency was found in the evaluation criteria of the models. Eight problems of such models are discussed which appear to reduce their utility for the study of organizational effectiveness. Suggestions are advanced for future work to focus on operative goals and goal optimization to further our understanding of the effectiveness construct in on-going organizations.

Steers, Richard M. and Mowday, Richard T. The motivational properties of tasks. Technical Report No. 7. ONR Contract No. N00014-76-C-0164. Eugene, Oregon: Graduate School of Management and Business, University of Oregon, September 1976.

This paper reviews six conceptual models of the motivational properties of tasks which have been presented recently in the literature. Each model is examined in terms of its scope and specificity in explaining motivational processes associated with task design. Specific suggestions are offered for future research aimed at improving the utility of such models for both investigators and managers. The need for more rigorous experimental designs and empirical data is emphasized.

Steers, Richard M. and Porter, Lyman W. The role of task goal attributes in employee performance. Technical Report No. 24, ONR Contract No. N00014-69-A-0200-9001, Irvine, California: University of California, 1974.

Research related to six factor-analytically derived attributes of employees' task goals is reviewed to ascertain which attributes are most consistently related to performance. The six "task goal attributes" are goal specificity, participation in goal setting, feedback, peer competition, goal difficulty and goal acceptance. Goal specificity and goal acceptance were found to be most consistently related to performance; however, several intervening variables emerged which affect significantly the impact of certain attributes on performance. It is argued that performance under goal-setting is a function of at least three important variables: the nature of the task goals, additional situational-environmental factors, and individual differences.

Steiner, I. D. Group dynamics. In Farnsworth, P. R. (Ed.), Annual Review of Psychology. Palo Alto, California, 1964, 15, 421-446.

Steiner concludes from his critical review that both the volume and the methodological sophistication of research increased during the three preceding years. No striking changes were found in conceptual orientation, except for increasing reliance on mathematical models. Theories continue to be eclectic in character and limited in scope. Failure to observe ongoing behavior was very apparent in studies of interpersonal perception, attraction and group productivity. Steiner agreed with the previous reviewer that "the future looks bright."

Steiner, I. D. Group processes and productivity. New York: Academic Press, 1972.

This book stresses the integrative role of task demands and group processes. Steiner inspects a limited number of phenomena in an orderly and systematic fashion, and describes a small but consistent network of interrelationships within his "modest" theory. Potential and actual productivity are treated as dependent variables and attention is focused on the factors that influence them.

Terauds, A., Altman, I., and McGrath, J. E.  A bibli-
    ography of small group research.  Report HSR-RR-60/2-Gn.
    Arlington, Virginia: Human Sciences Research, Inc.,
    April 1960 (AD 237-304).

Report contains a comprehensive (2,142 items) bibliography
of small group research studies through 1959.  This report
is one of several prepared for the Air Force Office of
Scientific Research under a contract initiated in 1957 and
on-going at the date of this bibliography.  Previous related
bibliographies are identified.

Terborg, J. R., Castore, C. H. and DeNinno, J. A.  A
    longitudinal field investigation of the impact of group
    composition on group performance and cohesion.  Tech-
    nical Report 80.  ONR Contract No. N00014-67-A-0226.
    Lafayette, Indiana: Purdue University, May 1975.

In a three-month field experiment, 42 groups were assembled
on the factors of individual ability and attitude similarity.
For each of six projects, measures of group performance and
group cohesion were taken.  Analyses showed that high ability
groups exhibited the best performance whereas attitudinally
similar groups expressed the greatest cohesiveness.  In
addition, correlational data suggest that the effect of
attitude similarity on cohesion is not immediate, but develops
over time; and that across the six projects, performance can
be positively and negatively related to cohesion.

Turney, John R.  The cognitive complexity of group members,
    group structure, and group effectiveness.  Cornell
    Journal of Social Relations, 1970, 5(2), 152-165.

Simulated business game was used in an attempt to relate
meaningful individual differences variable to group effective-
ness.  Thirty-five male undergraduates arranged along con-
tinuum of cognitive abstractness-concreteness, in eight groups.
Results show groups with majority of cognitively abstract
members were more effective than groups with a majority of
cognitively concrete members.

U. S. Air Force. Handbook for designers of instructional systems (Evaluation). AFP 50-58, 15 July 1973.

This five-volume pamphlet provides guidance in applying the Instructional System Development process described in AFM 50-2. The pamphlet is for the use of education and training personnel who plan, develop, approve, administer, or manage Air Force instruction and supporting materials. Volume V, Evaluation, provides guidance on how to conduct an internal evaluation and a field evaluation of an operating instructional system.

U. S. Air Force. Instructional system development. AF Manual 50-2, 31 December 1970.

This manual serves as the guide for applying the Air Force systems approach to the development of education and training programs. It presents a technology of instructional design and presents the model for developing cost-effective instructional systems. This manual applies to all education and training personnel who plan, develop, approve, administer, or manage Air Force instruction and its supporting materials.

U. S. Army. A cost assessment of army training alternatives. Research Problem Review 75-3. Alexandria, Virginia: ARI for Behavioral and Social Sciences, August 1975 (Reprinted March 1976).

The army has developed a system of self-paced audiovisual lessons--the Training Extension Course (TEC)-- designed to upgrade individual skills and to help commanders conduct this individual proficiency training. This report compared the estimated cost data of TEC training with conventional Army classroom instruction. Use of TEC individualized instruction with either cassette tape or audiovisual aids was projected to be less costly in comparison to conventional instruction as volume of use increases.

Valentnova, N. S. and Myedvyedyev, V. V.  Selected problems
    of small groups in sports teams.  International Review
    of Sport Sociology, 1973, 8(1), 69-77.

This study of important factors in producing effective,
harmonious group activity, used water polo players and foot-
ball players as subjects.  The groups characterized by
harmonious activity and mutual understanding performed best.
Groups with clearly defined leadership combined with "mixed"
leadership had the best coordination of activity.

Wagner, H., Hibbits, N., Rosenblatt, R. and Schulz, R.
    Team training and evaluation strategies:  A state-of-
    art review, SR-ED-76-11, Alexandria, Virginia: HumRRO,
    June 1976.

An  extensive and critical review of the literature is
presented.  A classification scheme was introduced in which
the training situations covered were categorized as
"emergent" (some discretionary behavior permitted because
all activities cannot be predicted) or "established" (tasks
and required behaviors almost completely specified).  Team
training is distinguished from "multi-individual" training.
State-of-the-art.gaps are identified and new techniques are
suggested for study of their applicability to team training.

Weinstein, A. S. and Holzbach, R. L.  Impact of individual
    differences, received distribution and task structure
    on productivity in a simulated work environment.
    Journal of Applied Psychology, 1973, 58, 296-301.

Study involved 72-male undergraduates divided into 3 groups
using coded responses to a questionnaire on standardized
forms found: (1) differential reward increased productivity
(i.e., within a group, the subjects with best performance
received more money), (2) intra-group task division reduced
performance, and (3) competition lowered satisfaction with
performance.

Wilson, Stephen R.  Some factors influencing instrumental and
    expressive ratings in task-oriented groups.  Pacific
    Sociological Review, 1970, 13(2), 127-131.

This study involved experimental efforts to determine the effects
of task-interest of the individual group member, the competence
of another contributing member, and the directiveness of the
other person.  It was found that these effects support the
author's explanation that:  (1) in lab groups where task-interest
is low, a member can recognize that certain members contributed
to solution without particularly liking those persons for it;
where task-interest is high the individual member should be
attracted to contributing members; (2) those contributing to
task tended to be "directive" and therefore not liked, especially
when task-interest is low.

Workie, A.  The relative productivity of cooperation and
    competition.  Journal of Social Psychology, 1974, 92,
    225-230.

Study involved 240 high school male students from largely upper-
middle class Jewish families on card-matching task.  Results
from 6 groups (40 each) were:  (1) intra-group cooperation more
productive than intra-group competition, (2) inter-group
cooperation more productive than inter-group competition, and
(1) in all cases cooperation better than no reference group whose
performance was better than competition.  Generalization limited.

Zagorski, H. J.  Normative evaluation in the operational
    environment.  Santa Monica, California:  System Development
    Corporation, 12 December 1973.

The author provides a description of the development, assessment
and validation of the experimental and operational form of the
NORM (Normative Operations Reporting Method) as "an automated,
statistically-based evaluation system that is being used today
in military performance assessment in complex environments."
Discussed are the NORM program system, performance data base,
analysis support package, and key assessment features, together
with an application in a hospital measurement and evaluation
context.  The example is discussed within the seven basic
processes that must be executed to achieve a NORM system.

Zajonc, R. B.  The effects of feedback and group task
    difficulty on individual and group performance.  ONR
    Technical Report No. 15, NOvember 15, 1961.

Zajonc studied the effects of direct and confounded feedback
under conditions which did not permit the mutual compensation
of errors by team members. A seven-man team, a signal light
stimulus, two independent variables (mixed and confounded
feedback) and criterion of group performance (individual and
team speed of reaction) was involved.  Subjects were trained
individually to an asymptotic level of performance and then
operated as a group.  Zajonc found: (1) individual performance
improved beyond asymptotic level when subjects worked in a
group, (2) both individual and group performance improved more
under mixed than confounded feedback when compensation was not
possible, and (3) individual performance did not change uni-
formly among all group members, i.e., slow performers were
more sensitive to task difficulty than to type of feedback but
the opposite was the case with fast performers.

Zajonc, R. B.  The requirements and design of a standard group
    task.  Journal of Experimental Social Psychology, 1965,
    1, 71-88.

Components of a standard group task (SGT) are set forth in
terms of individual psychology foundations; responses common
to any population; quantitative assessment of behavior as
individual and as group member; allowance for manipulation of
interdependence without changing basic character of responses;
and manipulation of parameters as to task difficulty, prob-
ability of success, complexity, and achievement of performance
feedback.  Additional general factors are economy of data
collection, stability of observations, and repeatability for some
subjects.

Zander, Alvin. Group aspirations. In Cartwright, D. and
    Zander, A. (Eds.) Group dynamics research and theory.
    New York: Harper & Row, 1968, 418-429.


This chapter contains a summary of findings from a series of
studies in the origins and effects of group aspirations
sponsored by the U. S. Air Force and Office of Education.
In addition to the broader significance, results and
conclusions relating to group performance are relevant. Ten
conclusions are reported from the findings of the various
studies.


Zander, Alvin. Motives and goals in groups. New York:
    Academic Press, 1971.


Presents a summary of the results of a program of studies
into a group aspirations and members' motives. Primary
attention in the investigations was given to members' plans
or actions on behalf of the whole group, and little atten-
tion was given to the interaction among members. Substantive
areas include group goals, group level of aspiration, external
social pressures, personal motives and desire for achievement,
and group performance and productivity factors and evaluation.
The results are summarized first in the form of research
outcomes related to a set of basic assumptions suitable for
discussing why aspirations happen as they do, and second in
terms of a number of variables and the events which follow
from the presence of each.

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